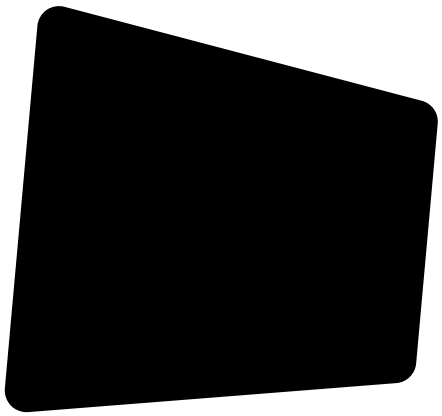

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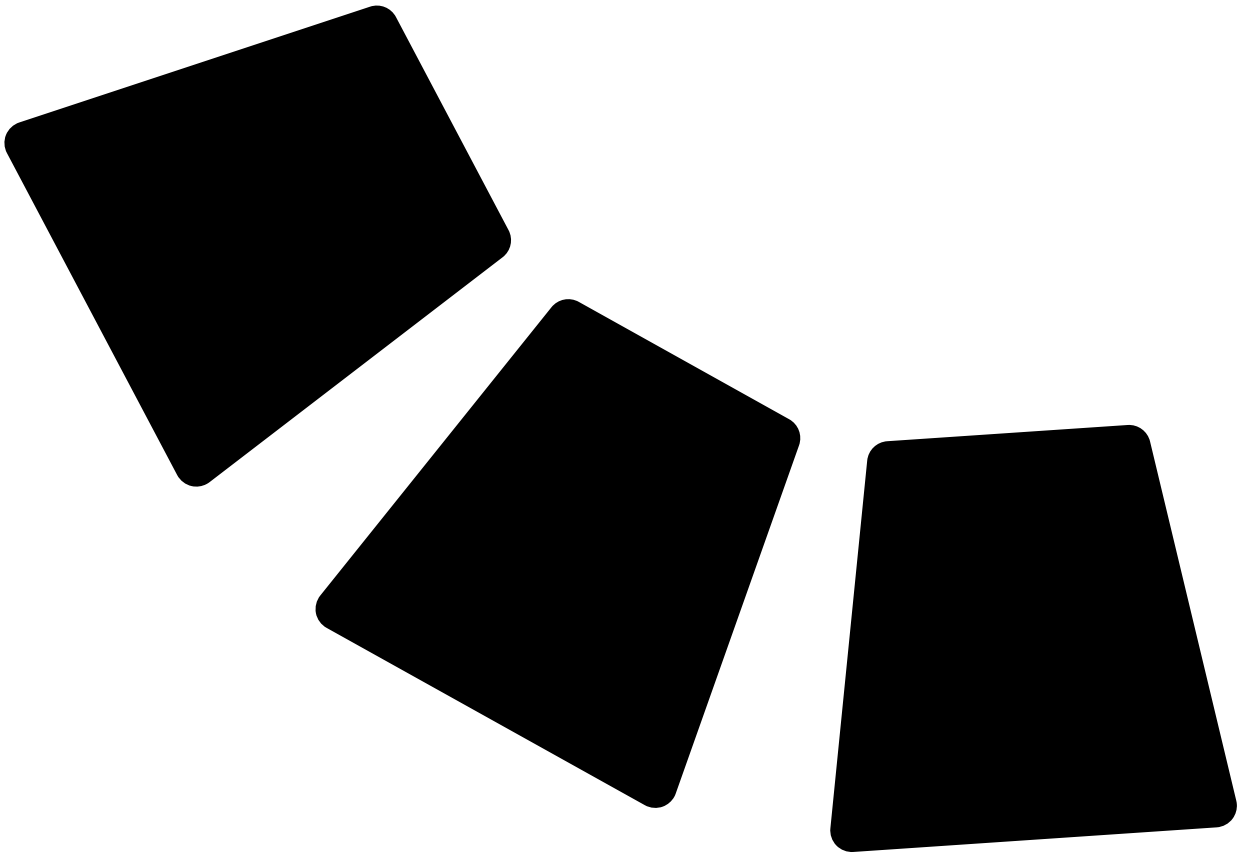

PROFESSIONAL ARRAY SYSTEM

manuale utente | user's manual

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Montarbo

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1 - AN INTRODUCTION TO "LINE ARRAY" SPEAKER SYSTEMS

This document describes the operating principles of the PALCOPLUS line-array system, as well as its main applications and features.
While not intended to be a complete technical essay about line-array systems, this chapter will provide a brief summary of the basic theory of operation and of the benefits of line array systems.
The following chapters will offer a description of the PALCOPLUS system and its applications, including wiring and flying information.
Understanding the physical principals that determinate the behavior of these systems will allow the user to optimize its application in mobile or fixed installations.

The desired result from any sound reinforcement system is high sound pressure and uniform coverage over the audience area.
This objective has often been addressed by using more powerful speakers, or a larger number of them.
The problems encountered using this strategy are well known.
Line array systems use a different approach to solve these problems.

1.1 - WHAT MAKES A LOT OF STACKED SPEAKER BOXES A "LINE-ARRAY"?

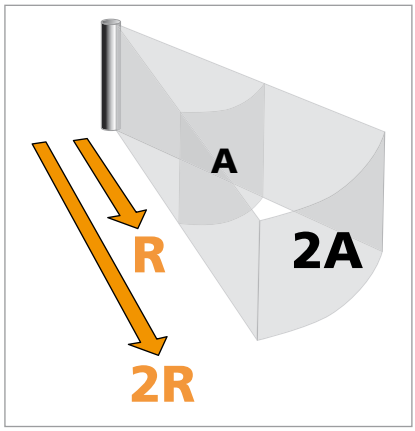


Figure 1. Cylindrical wave

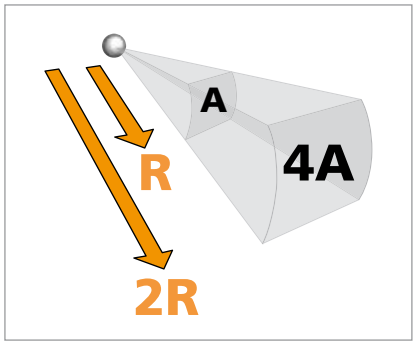


Figure 2. Spherical wave

The simplest definition of a "line array" is: a number of special independent units (loudspeakers), vertically stacked and aligned, that operate as a single sound source and which provide coherent summing, if some conditions are met.
The vertical stacking achieves a sound field that has a narrow vertical coverage, with higher directivity and sound pressure than conventional systems.
The sound waves emitted are referred as "cylindrical waves" (figure 1), and they attenuate only 3 dB for every doubling of the distance from the source, as opposed to the "spherical waves" (figure 2) emitted by conventional loudspeakers, which attenuate 6 dB for every doubling of distance.
This is true up to a distance from the source which is dependent upon its frequency and the height of the array, thus the longer the array is made (building it with more loudspeakers) the longer the throw of the system.
Cylindrical waves only expand in the horizontal plane, not in the vertical plane. The area doubles every time the radius (distance from the source) is doubled, which is equivalent to a loss of pressure of only 3 dB.

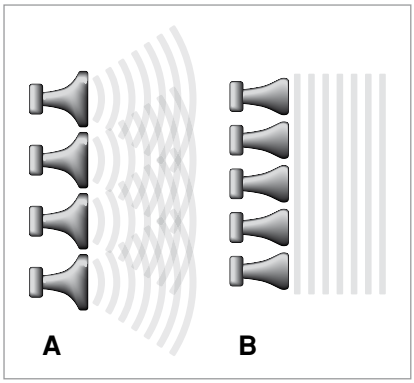


Figure 3. Plane waves: coherent radiation of multiple wave-guides

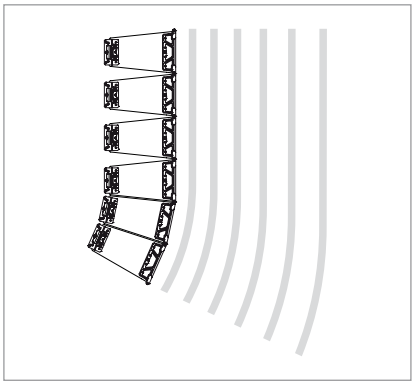


Figure 4. Radiation of a curved array

The loudspeakers ("elements") that make up a "line-array" must meet a certain set of conditions for the effects to be coherent and acceptable over a wide frequency range:
1 - The distance between the acoustic centers of the various elements must be equal to or lower than half the wavelength corresponding to the maximum frequency to be reproduced.
This means that an array made with small cabinets fitted with small loudspeakers may be effective to a higher frequency (it is for this reason that the PALCOPLUS RA16 loudspeaker is fitted with 8" woofers). This is true for frequencies that are higher than a critical one, that is a function of the array length. This means that, in order to correctly generate low-frequency cylindrical waves, the array must be very long.
2 - The separation between the high frequency radiators (wave-guides) must be minimal: the wave-guides must be tightly spaced. This is the reason that the array is assembled by tightly coupling the front of the loudspeakers. The wave-guides must be of special design, because the sound waves emitted must be time-coherent: they must generate plane waves. In this way there is no disruptive interference (figure 3 - A) between radiation from the separate wave-guides: they generate plane waves that sum coherently (figure 3 - B).

The theoretical line array should be a straight line, but in many cases this cannot be done, especially when the array must be flown.
A flown, straight array will not give adequate coverage throughout the audience area and, in practice, it may be necessary to curve the array in order to achieve sufficient coverage of the nearest areas.
This result in a J-shaped array, where the upper speakers (in a straight line) are used for the long-throw coverage and the lower speakers, in a curved line, are used for the short-throw coverage (figure 4).

Each speaker that makes up the line array must incorporate a rigging system that allows aiming in the vertical plane.
The rigging system, usually an integral part of the units, allows for hinging at the front of the box so that the separation between the speakers stays the same, while the rear plates allow for adjusting the angle between speakers ("splay" angle).
A software program is used to determine the correct angle between the various speakers of the array. Starting from the geometry of the venue, the desired coverage and the number of speakers available, this program will give the correct splay angle between the speakers and the correct rigging point. For the PALCOPLUS system we supply the custom EASE FOCUS software.

1.2 - REPRODUCTION OF LOW FREQUENCIES

For the reasons explained above, a line-array's low frequency reproduction is limited by the array's length (and by it's components).
Special low frequency units are thus used.
To extend the response to the lowest octaves, the PALCOPLUS system utilizes a specially designed sub-bass unit, model RAB1815.
It's two low frequency woofers, an 18" and a 15", are acoustically loaded in different ways, while the geometry of the system and the frequency and phase correction supplied by the LM24 digital controller or by the digital controller integrated into the PLM6800 'powered controller' transform it into a directive low-frequency source, with a cardioid directivity pattern.
The RAB1815, due to it's size and weigh, is not intended to be flown.

2 - SYSTEM COMPONENTS

The PALCOPLUS line array is a system, made up of different components that must be used together for maximum results:
- **RA16 - enclosure**
- **BUMPER** (model **B1** or **B2**)
- **RAB1815 - cardioid sub-bass unit**
- **LM24 - digital controller (with RACon PC software) or, as an alternative,**
- **PLM6800 'powered controller' 4-channel power amplifier**
- **LD2.4 - USB interface**
- **EASE Focus - Aiming Software**

Figure 5. RA16

Figure 6. Integral rigging system

Figure 7. Vertical angle adjustment bars and quick release pins

2.1 - RA16 - enclosure (figure 5)

Two-way speaker system, equipped with 2 woofers in a dipole configuration (8" with 2.5" moving coil, neodymium magnet) and an HF driver with a 3" titanium diaphragm, neodymium magnet, loaded by a plane wave guide with 1.4" throat.
The cabinet is built from tough 15 mm Finnish birch with a special coating providing very high resistance to abrasion; it weights just 18 kg, including the special steel suspension fittings (figure 6).
For each speaker an external power amplifier is specified, with at least 800 W / 8 ohms for the woofers and 200 W / 16 ohms for the driver.
A two channel amplifier (1600 W / 4 ohm per channel) is suitable for driving two units.
The frequency range is 70 Hz ÷ 20 kHz, the crossover is at 800 Hz, 24 dB/octave.

Each enclosure is supplied with:

- 2 rear steel plates that allow the assembly of the enclosures in the array and for adjusting the vertical splay angle between units (figure 7 - A).

- 6 highly resistant quick release pins (figure 7 - B) with ball safety lock (3/8" x 1/2").

Connection to power amplifiers is by a 4-pole NEUTRIK SPEAKON® socket.
A second socket allows parallel connection of a second speaker (figure 8).
Refer to chapter 5 for wiring details.

Figure 8. RA16 Rear panel

Figure 9. BUMPER - model B1

2.2 - BUMPER - model B1 (figure 9)

Suspension frame (grid) made of high-resistance steel, certified for flying up to 16 RA16 units and that doubles as lower base for stacked installations of up to 6 RA16 units on stage surface or on an RAB1815 unit.
If the BUMPER is stacked on an RAB1815, then the user must install suitable anti-slip feet (not supplied), screwed into the M16 inserts incorporated in the BUMPER. If the BUMPER is lpositioned on the ground or stage surface, the use of the anti-slip feet is suggested, but not mandatory.
The BUMPER has several hoisting points, that will give different aiming angles ("tilt" angles) when the system is flown.
The BUMPER is fitted with 4 fixing plates for 100 mm casters (not supplied).
It is supplied complete with 6 (3/8" x 1") quick release pins.

CAUTION: to fix the BUMPER, use the quick release pins supplied with it exclusively. DO NOT use the pins supplied with the RA16 enclosures !!!

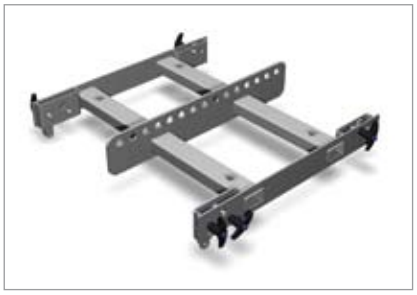


Figure 10. BUMPER LIGHT - model B2

2.3 - BUMPER LIGHT - model B2 (figure 10)

Similar to model B1, but lighter. It is certified for flying up to 8 RA16 units and doubles as a lower base for stacking on the ground or stage surface a maximum of 4 RA16 units (after the mandatory installation of suitable anti-slip feet, not supplied). It is supplied complete with 6 (3/8" x 1") quick release pins.

CAUTION: to fix the BUMPER, use the quick release pins supplied with it exclusively. DO NOT use the pins supplied with the RA16 enclosures !!!

CAUTION: in case of use of the BUMPER (mod. B1 or mod. B2) laid on the ground or stage surface, the position of the center of mass must be verified by means of the EASE Focus program.

Both B1 and B2 BUMPERS are supplied with front suspension plates, for connecting them to the first speaker of the array. These plates are retained in their transport position (protected) by two quick release pins.
These pins must be removed to rotate the plates into their operating position (see chapter 4).

The EASE FOCUS software will suggest the optimal rigging point for the desired result.
For the correct use of the BUMPERS, especially regarding maximum load and rigging point, refer to chapters 3 and 4.

Figure 11. An array of 8 RA16 speakers flown from the BUMPER

Figure 12. RAB1815

2.4 - RAB1815 - cardioid sub-bass unit (figure 12)

Cardioid sub-bass, designed to extend the low frequency range of the PALCOPLUS system to 30 Hz.
It employs two low-frequency drivers: an 18-inch (bass-reflex-loaded) and a 15-inch (horn-loaded), both featuring a 4-inch, long-excursion voice coil, a dual-spider and a super-ventilated neodymium magnet.
The synergy between the drivers results in a "fast" and accurate bass response. The drivers' different acoustic loads compensate their frequency response and extend and correct the system's response in the very low range, thus increasing its throw and directivity.
The polar response is "cardioid" within a large band. A conventional woofer has a response that is practically omni-directional. Instead RAB1815 has a "directive" response, meaning that the acoustic energy is directed only where it is needed. The reduced emission from the enclosure's rear helps attenuate the low frequency acoustic feedback on stage.
For each module a two channel power amplifier (2 x 1600 W / 4 ohm) is specified; this amplifier is driven by the dedicated LM24 controller.

Figure 13. RAB1815 rear panel

Connection to power amplifiers is by an 8-pole NEUTRIK SPEAKON® socket (figure 13). For wiring details, refer to chapter 5.

One RAB1815 sub-bass unit may be used as a base for a ground or stage level stacked array of RA16 speakers, installed on top of BUMPER model B1 (figure 14).

Figure 14. An array of 4 RA16 speakers stacked on a model B1 BUMPER and an RAB1815

Figure 15. LM24

2.5 - LM24 - digital controller (figure 15)

Thanks to it's "state-of-the-art" DSP and A/D and D/A converters, this unit will drive the system's power amplifiers; operating simultaneously as a cross-over, equalizer and limiter to optimize the system's response.
It may be used in a free-standing mode, utilizing the front panel's LCD display and keyboard to operate on factory pre-sets with adjustable parameters; or it may be controlled by a personal computer that, thanks to the RACon control software and the LD2.4 USB interface (figure 16), allows adjustment and configuration of a network of up to 8 LM24 controllers.
For wiring instruction, refer to chapter 5.
For detailed instructions about the LM24 and the RACon PC software, refer to the LM24 user's manual.

Figura 15b: PLM6800

2.6 - PLM6800 'powered controller' 4-channel power amplifier with digital loudspeaker management (figure 15 b)

Model PLM6800 is a "powered loudspeaker controller" designed to be used with the PalcoPlus line-array system. It incorporates a digital controller (functionally equivalent to the model LM24) and four power amplifiers, each one capable of delivering up to 1700 W @ 4 ohms.
A single PLM6800 may effortless drive one PALCOPLUS system composed by two RA16 speakers and one RAB1815 woofer. The system's wiring is made easy thanks to an 'intelligent' control of the power amps output wiring, offering a real protection of the system's drivers against wiring errors.
The PLM6800 may be used in free-standing mode by means of the front panel's LCD display and keyboard, operating on factory pre-sets with adjustable parameters, or it may be controlled by a personal computer that, thanks to the RACON control software and the LD2.4 USB interface, allows adjustment and configuration of a network of up to eight PLM6800.

Figura 16. USB LD2.4 interface

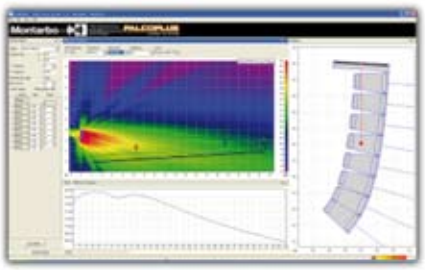


Figure 17. EASE Focus screen shot

2.7 - EASE Focus - Aiming Software (figure 17)

Dedicated acoustical simulation software: starting from a geometric model of the actual venue space (geometry of the place, audience position, number of speakers to be used), it will compute, in an interactive mode, the array's geometry, calculating the splay angles to be assigned to the array modules during the array assembly.
It will also indicate the exact position of the hoisting point on the BUMPER, so that the array will have the correct tilt angle once flown.
For instructions about the software's installation, refer to chapter 9.
The program includes a complete and detailed on-line help, and we suggest that the user refer to it for more details.

3. RIGGING THE SYSTEM

This chapter contains important information about flying a PALCOPLUS line array system, as well as a description of the elements and safety precautions.
Our goal is to allow the user to become familiar with the procedures to be followed while flying the acoustic system, as well as the safety measures to be taken during set-up and disassembly.
Before performing any operations related to flying the system, read the present chapter first, and heed the warnings and advice given.

Only experienced persons with the required knowledge of the equipment and local safety regulations should fly speaker systems.

It is the user's responsibility to ensure that the systems to be flown (including flying accessories such as structures, hoists, chains and cables) comply with applicable government and local regulations.

The working load limits stated in this manual have been certified by independent laboratories.

It is the user's responsibility to comply with loads limits, safety factors, resistance values, periodical checks and all the warnings given in this manual.

The suspension accessories supplied by Montarbo are suitable for rigging:
• up to 8 RA16 speakers with a B2 BUMPER
• up to 8 RA16 speakers with a B1 BUMPER, when using a single suspension point
• up to 16 RA16 speakers with a B1 BUMPER, when using two suspension points.

The loading capacity of the suspension accessories supplied by Montarbo have been certified by an external structural design consultant.
A partial copy of the certification document is enclosed in the appendix.
The compete document, in it's original form, is available at the Montarbo main offices.

3.1 - SAFETY STANDARDS AND REGULATIONS

To this date and to our knowledge, there is no accepted standard or regulation regarding the flying of acoustic systems.
However, it is common engineering practice to apply 5:1 safety factors for enclosures and static elements.
For slings and elements exposed to material fatigue due to friction and load variation, the following ratios must be met:
5:1 for steel cable slings,
4:1 for steel chain slings and
7:1 polyester slings (not allowed in some countries)
Thus, an element such a steel chain, with a breaking load limit of 1000 Kg may be statically loaded with 250 Kg (4:1 safety factor).

When flying a system, the working load must be lower than the resistance of each individual flying point in the array, as well as on each enclosure.

3.2 - SAFETY CHECKS AND INSPECTIONS

Hanging hardware should be regularly inspected and suspect units replaced if there is any doubt.
This is important to avoid injury and damage, and absolutely no risks should be taken in this respect.

We strongly recommend that an inspection and maintenance program on flying elements be implemented.
This should be done in a written form and include reports filled out by the personnel that will carry out the inspections.
In case of accident, local regulations may require you to present evidence of inspection reports and corrective actions taken after defects were found.

Regulation on hoist and chain maintenance in some countries require a programmed inspection and maintenance program to be performed by a Certified Body or by a competent professional.

No risks should be taken with regards to public safety. Absolutely!
When flying enclosures from ceiling support structures, extreme care should be taken to assure, by calculation and in some cases by actual measurement, that the load-bearing capabilities of the structures are not exceeded, so that the installation is absolutely safe.

Do not fly enclosures from unsafe structures. Consult a certified professional if needed.

All flying accessories that are NOT supplied by Montarbo are the user's responsibility. Use at your own risk.

4 - SETTING UP AND ASSEMBLING THE ARRAY

The mechanical set-up of the array is carried out in two phases:

a) assembly of the RA16 speakers and the BUMPER, using the rear rigging plates (that allow joining the speakers composing the array and adjusting the splay angle between adjacent speakers) and the quick-release pins, featuring a ball safety lock (QuickLock).
b) "flying" the system or positioning it on the ground or stage floor.

To simplify the operation, the two phases may be carried out simultaneously.

The suspension accessories supplied by Montarbo are suitable for rigging:
• up to 8 RA16 speakers with a B2 BUMPER
• up to 8 RA16 speakers with a B1 BUMPER, when using a single suspension point
• up to 16 RA16 speakers with a B1 BUMPER, when using two suspension points.

Before beginning the assembly work, the array geometry (the splay angles between the different RA16 enclosures) must be determined using the EASE Focus software program, then the following operations must be carried out:

Figure 18.1

1) Align on the floor or on a horizontal plane (e.g. a wooden board of suitable size and strength) all the RA16 speakers and the BUMPER (figure 18.1).
Make sure that their orientation is correct (top-bottom).

Figure 18.2

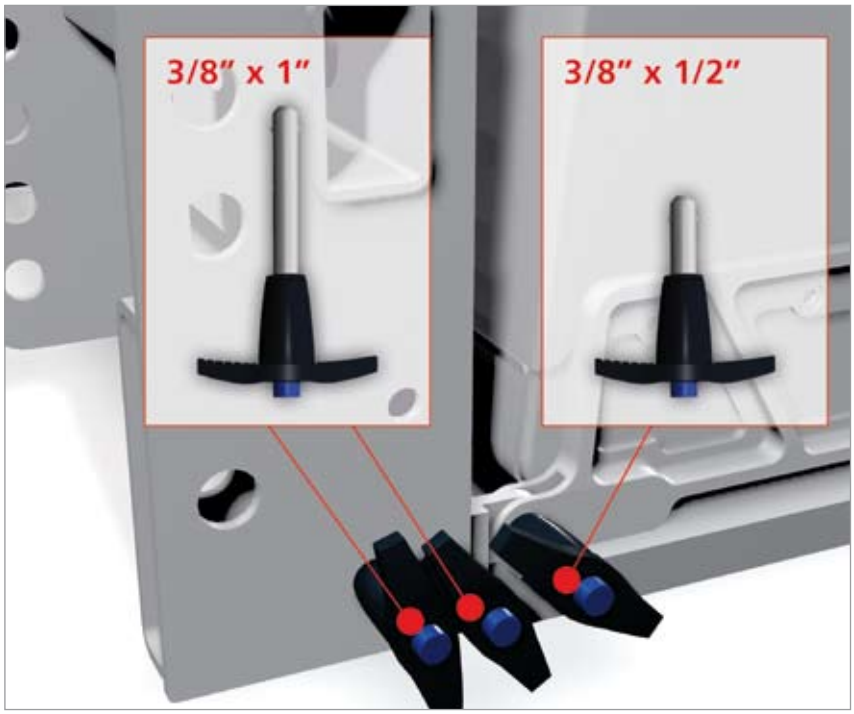
2) Make sure that the BUMPER is placed under the support structure's rigging point (figure 18.2).

3) Join all the speakers, using only the front plate holes, using two pins per speaker (figure 18.3).

Figure 18.3

4) Remove the two pins that retain the front plates of the BUMPER in the transport position. Rotate the plates into the working position (horizontal) and fasten them with the two pins removed before (figure 18.4).

Figure 18.4



5) Join the front plate of the first speaker and the front side of the BUMPER, using the front plates of the BUMPER and two pins (figure 18.5).

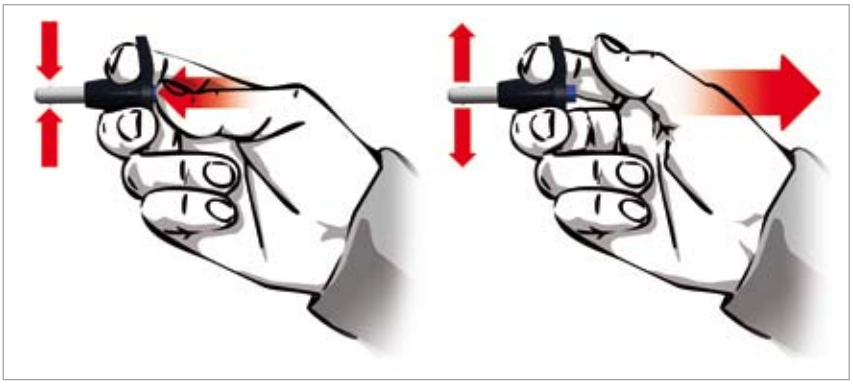
CAUTION: to fix the BUMPER, use the quick release pins supplied with it exclusively.
DO NOT use the pins supplied with the RA16 enclosures !!!

Figure 18.5

6) Connect the rear side of the BUMPER to the rear of first speaker by means of 2 plates and 2 pins, **using the attachment holes marked for 0° splay angle** (figure 18.6).

CAUTION: to fix the BUMPER, use the quick release pins supplied with it exclusively.
DO NOT use the pins supplied with the RA16 enclosures !!!

Figure 18.6



7) Always verify that the pins are inserted correctly, by trying to remove them:
it is mandatory that they cannot be extracted if the release button is not pressed (figure 18.7).

Figure 18.7

To determine what attachment holes correspond to a certain angle, refer to figure 19: insert pins in the black colored holes.
A copy of figure 19 is drawn on the RA16 rear panel.

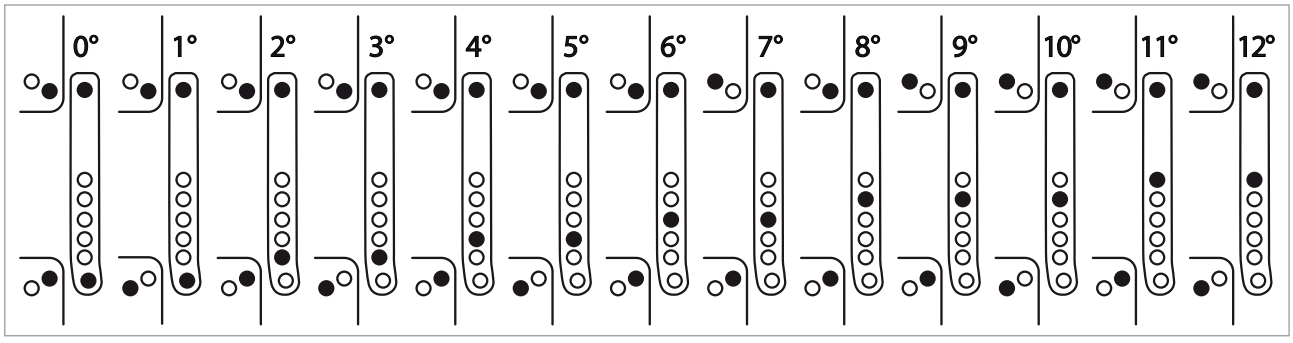
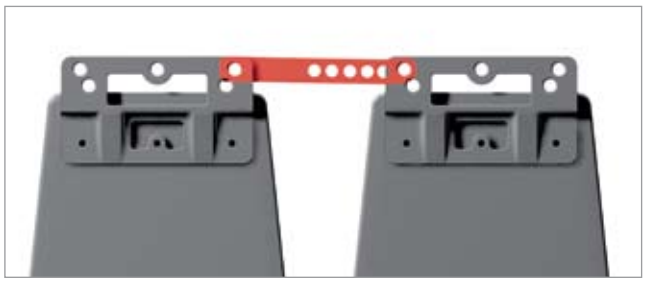
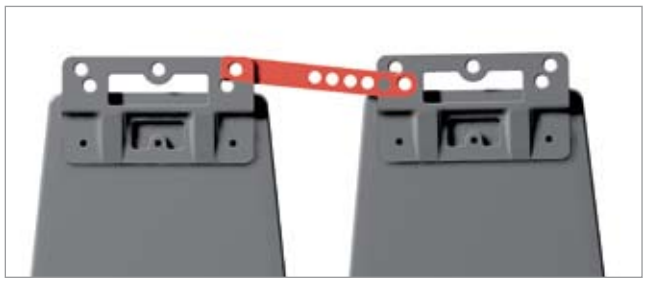


Figure 19. Correspondence between fixing holes and splay angle

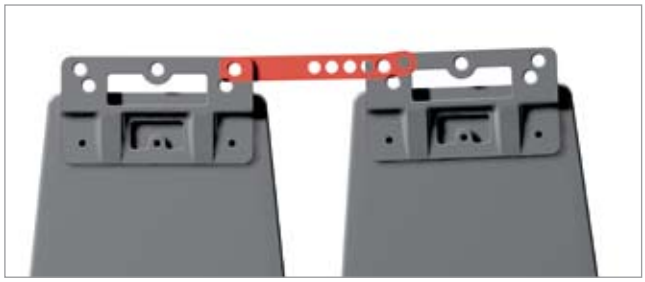
The following images illustrate the correspondence between the holes on the rear plate and the holes on the RA16 suspension system, as a function of the desired splay angle.



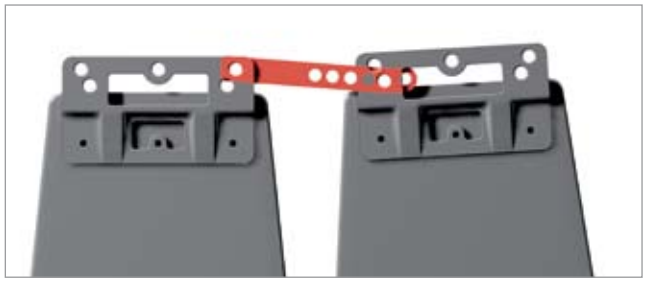
Splay angle: ***0°***



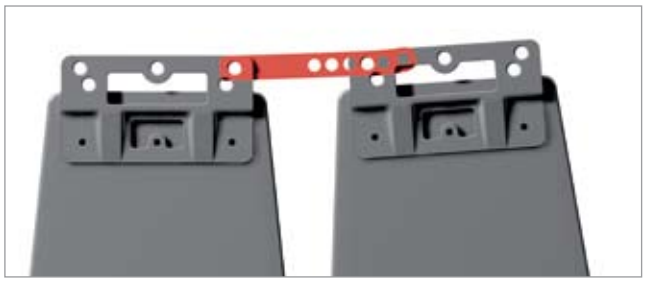
Splay angle: ***1°***



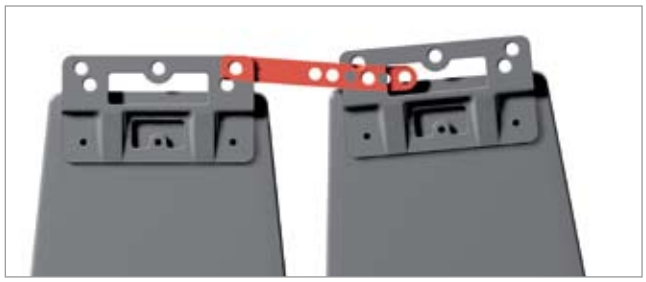
Splay angle: ***2°***



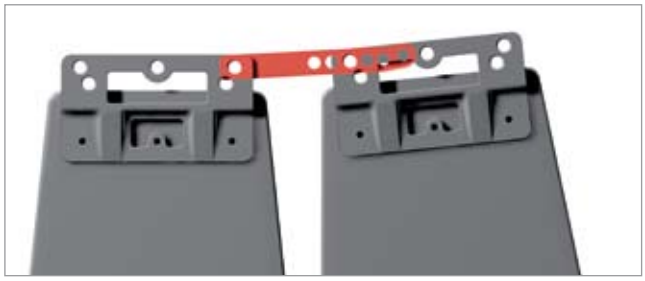
Splay angle: ***3°***



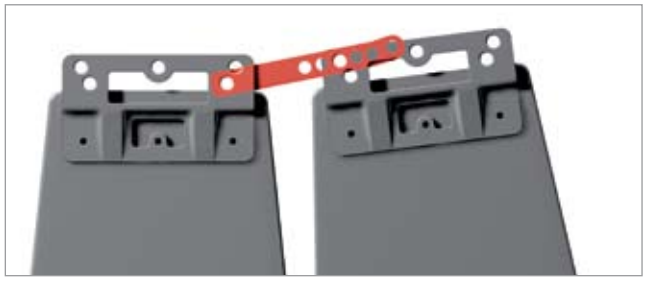
Splay angle: ***4°***



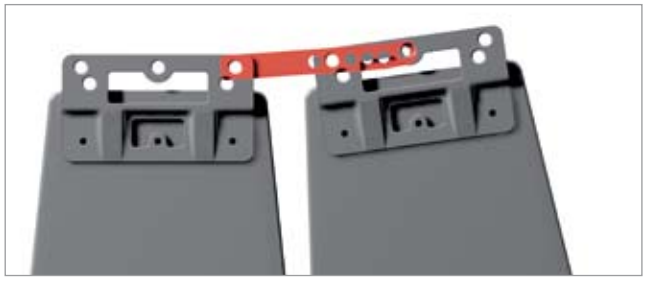
Splay angle: ***5°***



Splay angle: ***6°***

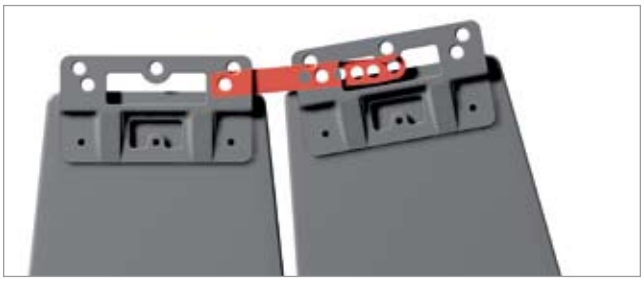


Splay angle: ***7°***

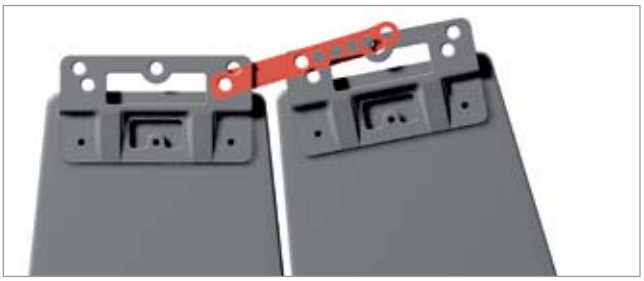


Splay angle: ***8°***

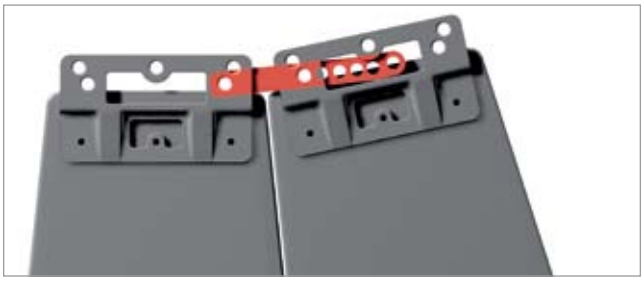
Splay angle: ***9°***



Splay angle: 10°



Splay angle: 11°



Splay angle: 12°

Figure 20

8) Join together the backs of the speakers, starting from the top of the array: moving from the first to the second, the second with the third, and so on to the last one, always using 4 pins and 2 plates, and setting the desired splay angles.
If a splay angle different from 0° is required, after first attaching the plates to the upper speaker, rotate the lower speaker so that the desired attachment holes on the plates are aligned with those on the speaker.
The light weight of the speakers allows them to be rotated by holding the handles of the two adjacent speakers with one hand, as shown in figure 20.
If this procedure turns out to be too difficult or impractical (when the array is very long or in cases of very marked curvature), it is possible to attach the BUMPER to the hoist and slowly begin the system rigging, so that the speakers are at the desired angle (figure 21).

In some cases it may be more practical to assemble blocks of four loudspeakers, and to fix the first one directly to the rigging structure. After a partial lift of the structure, other blocks of the array may then be added (figure 22).

Figure 21

Figure 22

9) When the whole array has been assembled and still on the ground it is advisable to attach the speaker cables, as described in chapter 5, before flying.

10) Once the cables have been connected, the array may be flown.
Follow all the applicable safety precautions (as described in chapter 3), and be sure to secure safety cables and guy lines.
Check the tilt angle using a clinometer.

Please remember that the suspension accessories supplied by Montarbo are suitable for rigging:
• up to 8 RA16 units with a B2 BUMPER using a single suspension point (figure 23)
• up to 8 RA16 units with a B1 BUMPER, when using a single suspension point (figure 24)
• up to 16 RA16 units with a B1 BUMPER, when using two suspension points (figure 25).

Figure 23 - BUMPER B2. Single suspension point

Figure 24 - BUMPER B1. Single suspension point

Figure 25 - BUMPER B1. Two suspension points

Figure 26

11) In the case of arrays placed on the stage floor or stacked on a subwoofer, follow the procedures described above, bearing in mind that floor arrays must be inverted and that the BUMPER must be placed underneath to support the array (figure 26).
It is mandatory to install suitable anti-slip feet when placing a B2 BUMPER on stage floor or ground.
For the B1 BUMPER, the installation of anti-slip feet is suggested when positioning it on ground or stage floor, but it is mandatory when stacking it on an RAB1815 woofer.

CAUTION: in case of use of the BUMPER (mod. B1 or mod. B2) placed on ground or stage surface, the position of the center of mass must be verified by means of the EASE Focus program.

5 - SYSTEM WIRING

Due to the low impedance of the speakers and the high power levels involved, it is necessary to use cables with adequate copper section.
For a simpler approach, we recommend the use of 4-conductor cables wired to NEUTRIK SPEAKON® plugs (type NL-4 for the RA16 enclosures and NL-8 for the RAB1815 sub-bass units).
Each cable conductor must have the minimum cross section shown in the following table.
The cables must be of adequate quality, with a flexible insulation, suitable for the installation's environmental conditions, and with sufficient copper section to minimize power loss.

Cable length	Cable section
up to 20 meters	2.5 mm^2 (AWG 10)
more than 20 meters	4.0 mm^2 (AWG 6)

Each pair of RA16 enclosures requires an interconnection cable, 0.5 meters long, equipped with NEUTRIK SPEAKON® NL-4 plugs, at least 4 x 1.5 mm^2.

The high power involved necessitates the correct wiring of the system: any error in wiring or any cable reversal will result in serious damage to the speakers.

The array speakers are wired as follows:

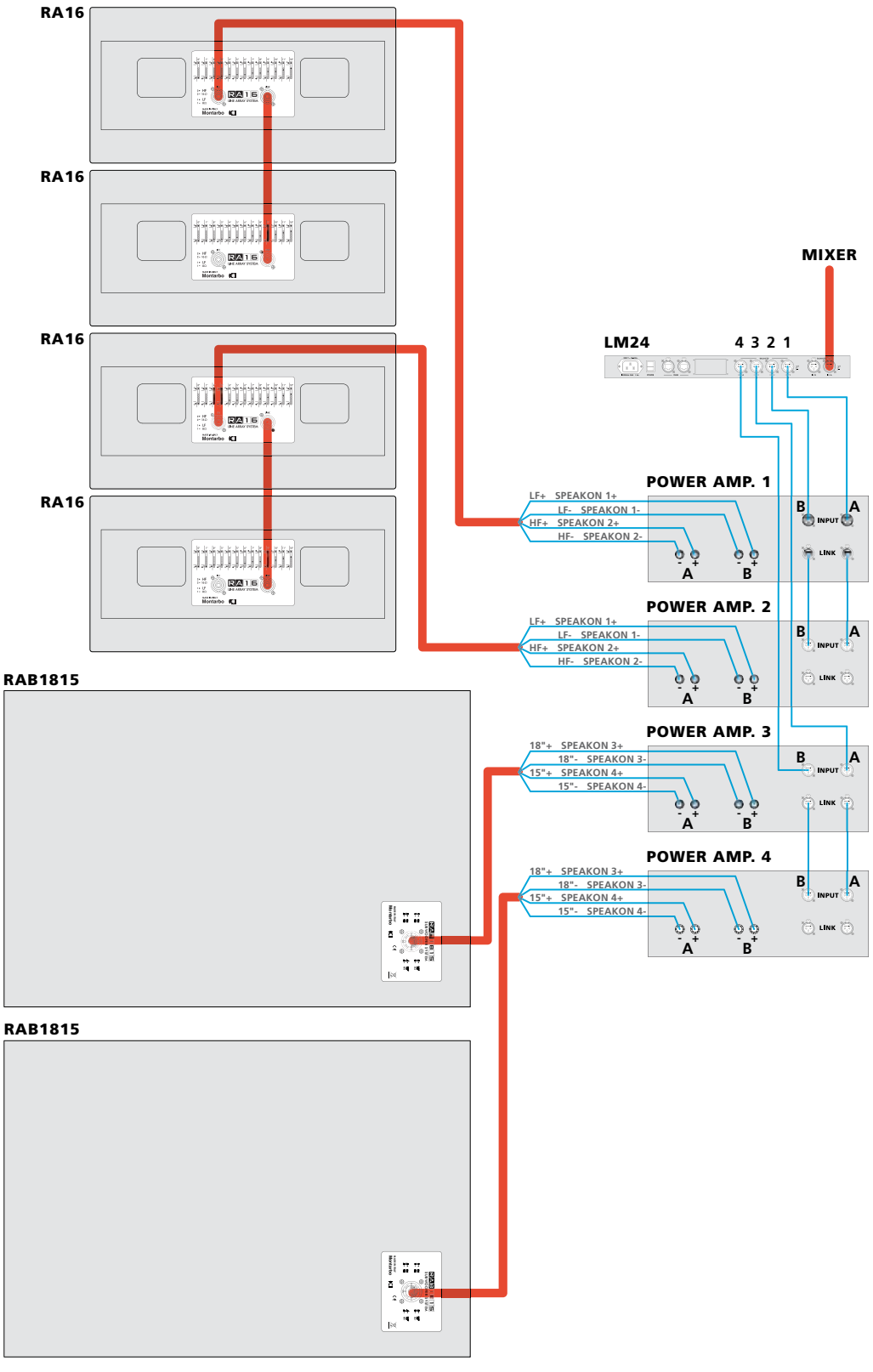
Neutrik Speakon® NL- 4 pins	RA16
1+	LF+ (8 ohm)
1-	LF-
2+	HF+ (16 ohm)
2-	HF -
Neutrik Speakon® NL- 8 pins	RAB1815
1+	n.c.
1-	n.c.
2+	n.c
2-	n.c.
3 +	18" + (4 ohm)
3 -	18" -
4 +	15" + (4 ohm)
4 -	15" -

To connect the mixer to the LM24 controller, and the controller to the power amplifiers, always use SHEILDED cables (signal cables, balanced), of adequate section and quality.

The system's wiring is a function of the selected set-up.
The following pages illustrate the wiring corresponding to the LM24 controller's factory Set Up (pages 57-63) and to the PLM6800 powered controller's factory Set Up (pages 64-68).

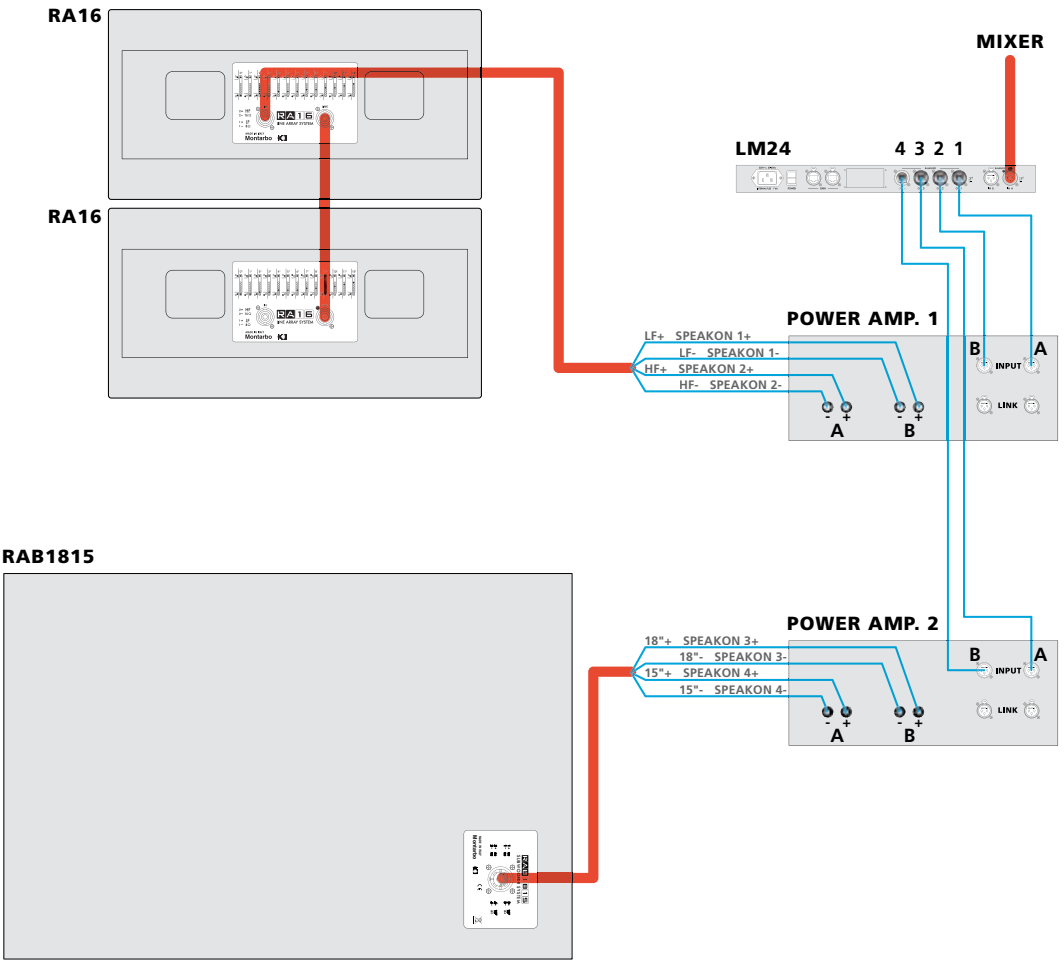
PALCOPLUS wiring with LM24 controller - standard configuration (RA16 + RAB1815 A Flw)

Name	Description	Input A	Input B	Output 1	Output 2	Output 3	Output 4
RA16 + RAB1815 A Flw	PalcoPlus Standard	mono	disabled	RA16 HF (2 couples) suspended	RA16 LF (2 couples) suspended	RAB1815 15" (1 couple)	RAB1815 18" (1 couple)



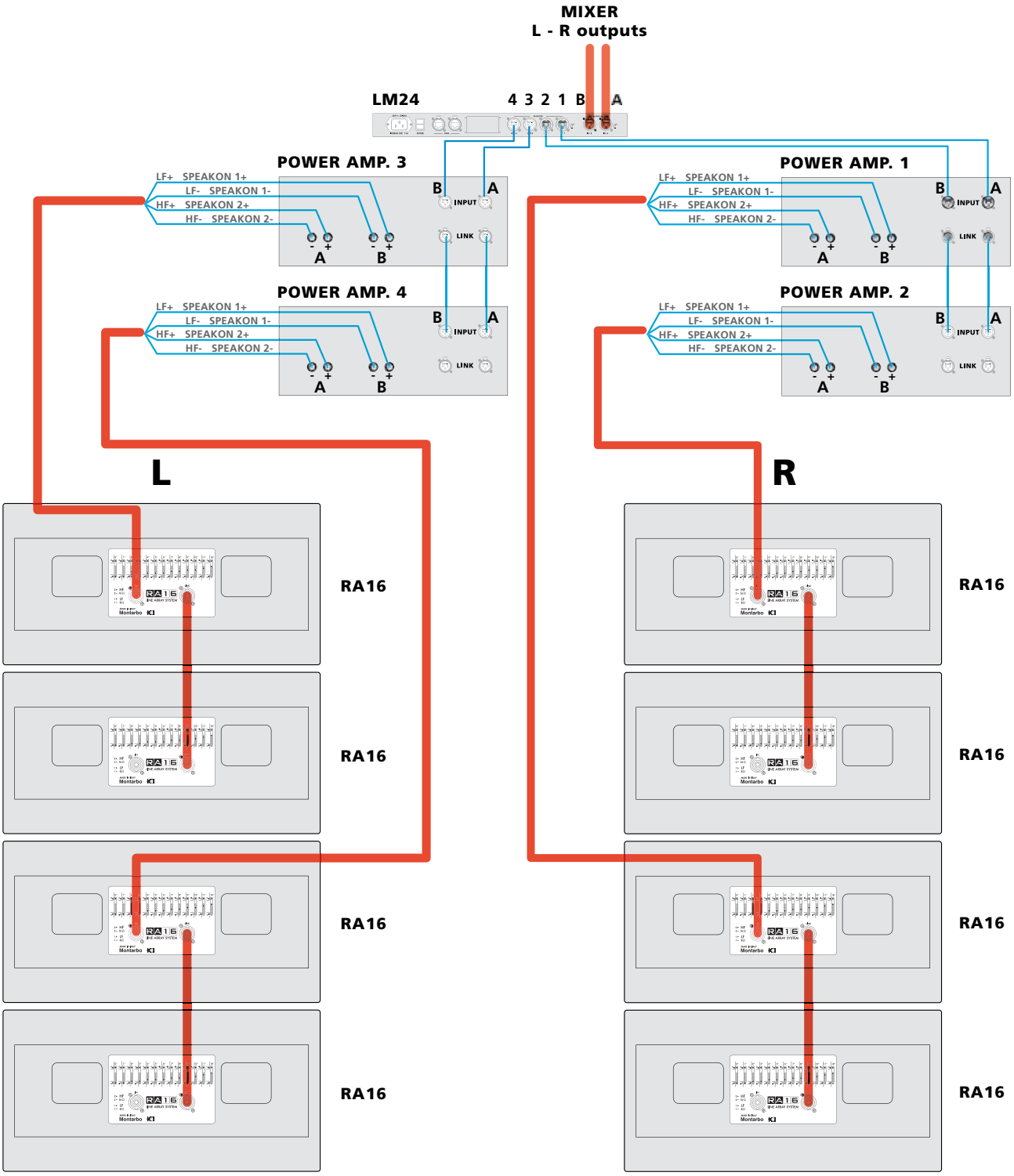
PALCOPLUS wiring with LM24 controller - small configuration (RA16 + RAB1815 A Stk)

Name	Description	Input A	Input B	Output 1	Output 2	Output 3	Output 4
RA16 + RAB1815 A Stk	PalcoPlus Reduced	mono	disabled	RA16 HF (1 couple) stacked	RA16 LF (1 couple) stacked	RAB1815 15" (single)	RAB1815 18" (single)



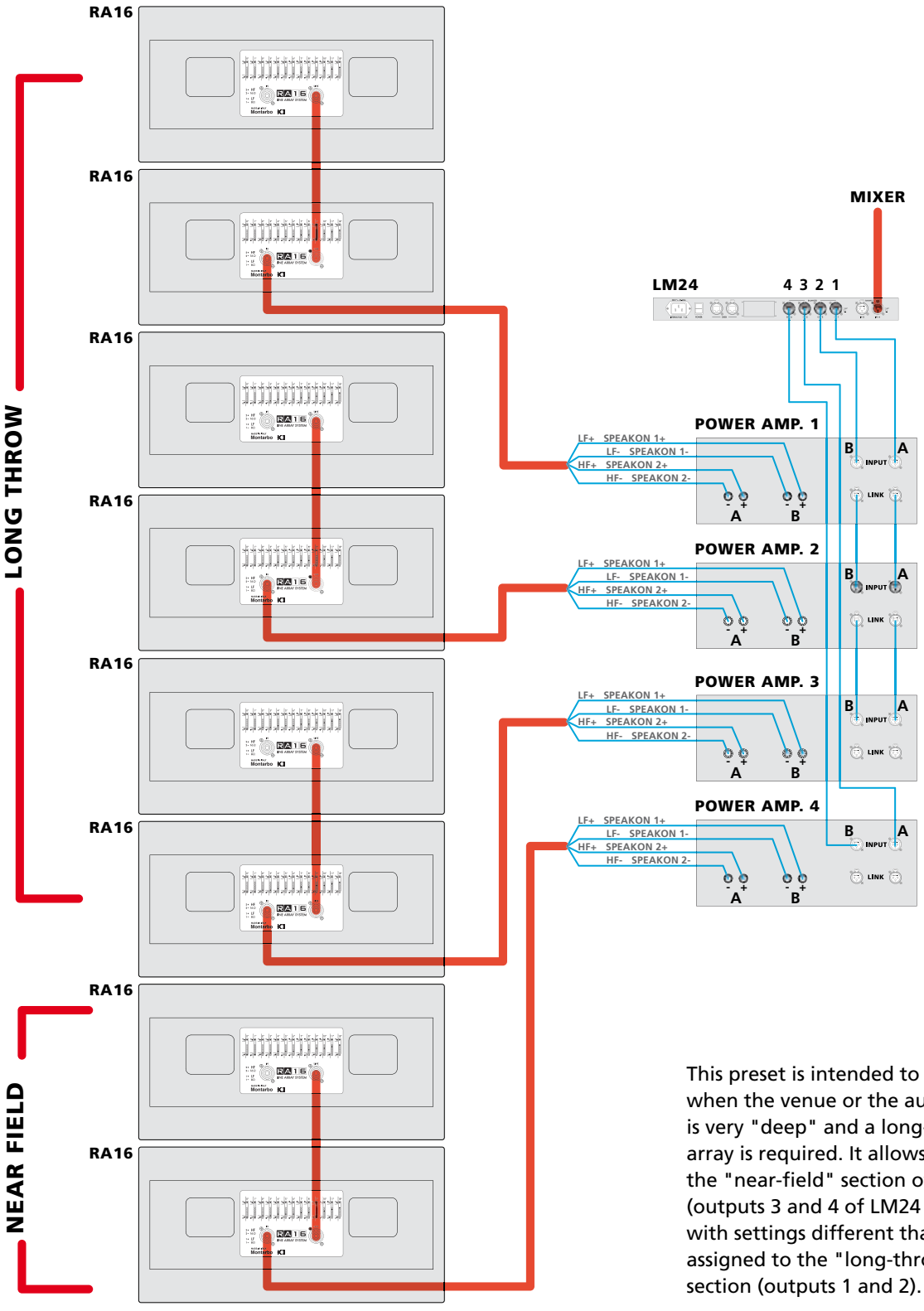
PALCOPLUS wiring with LM24 controller - stereo configuration (RA16 + RA16 A&B)

Name	Description	Input A	Input B	Output 1	Output 2	Output 3	Output 4
RA16 + RA16 A&B	RA16 stereo	L Channel	R Channel	RA16 HF (2 couples) suspended - L	RA16 LF (2 couples) suspended - L	RA16 HF (2 couples) suspended - R	RA16 LF (2 couples) suspended - R



PALCOPLUS wiring with LM24 controller - split RA16 array configuration (RA16 Ch4)

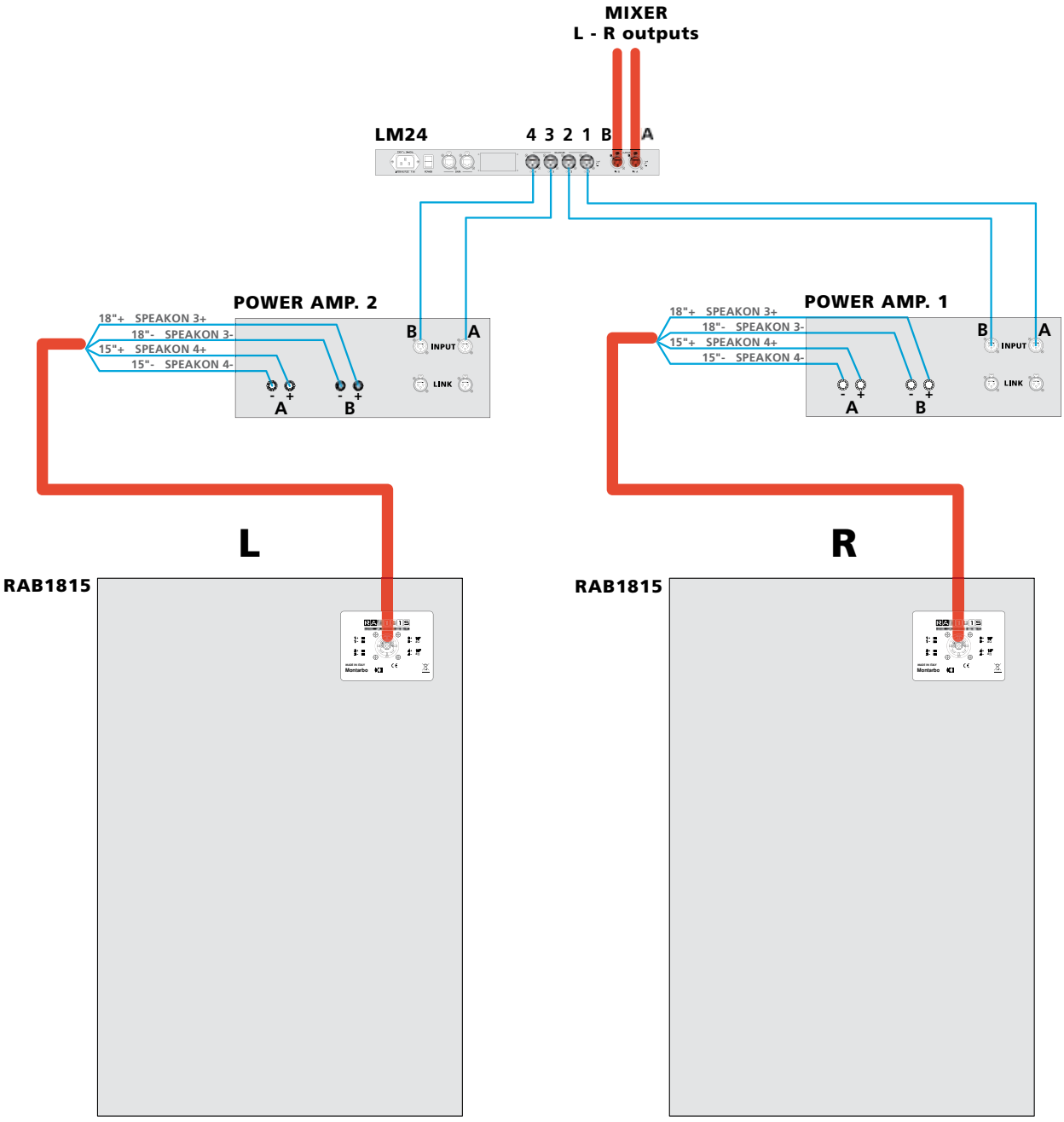
Name	Description	Input A	Input B	Output 1	Output 2	Output 3	Output 4
RA16 Ch4	RA16 split array	mono	disattivato	RA16 HF (3 couples) suspended high	RA16 LF (3 couples) suspended high	RA16 HF (1 couple) suspended low	RA16 LF (1 couple) suspended low



This preset is intended to be used when the venue or the auditorium is very "deep" and a long-throw array is required. It allows to control the "near-field" section of the array (outputs 3 and 4 of LM24 controller) with settings different than those assigned to the "long-throw" section (outputs 1 and 2).

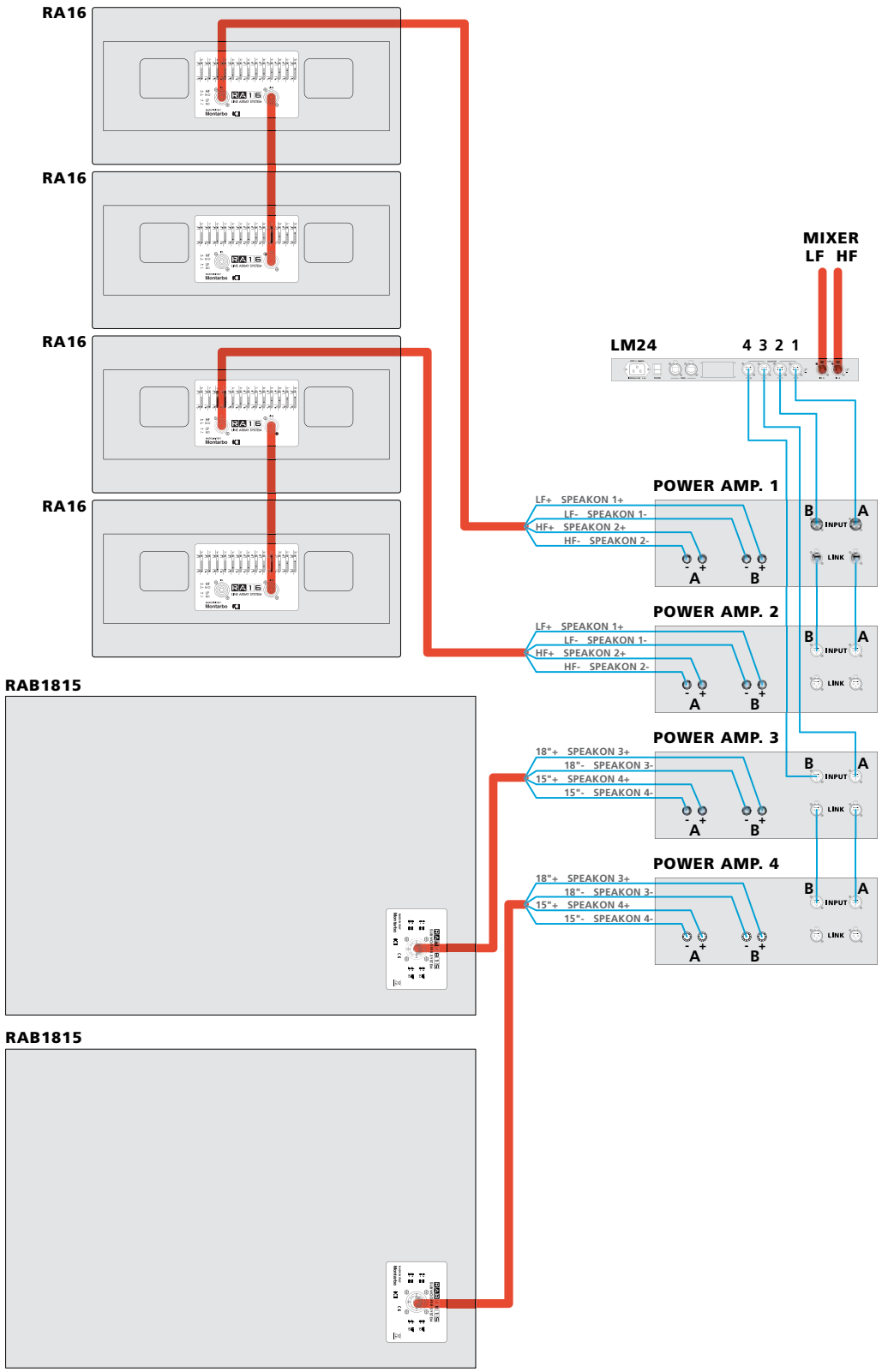
PALCOPLUS wiring with LM24 controller - RAB1815 split (RAB1815 A&B)

Name	Description	Input A	Input B	Output 1	Output 2	Output 3	Output 4
RAB1815 A&B	RAB1815 split array	L Channel	R Channel	RAB1815 15" R Channel	RAB1815 18" R Channel	RAB1815 15" L Channel	RAB1815 18" L Channel



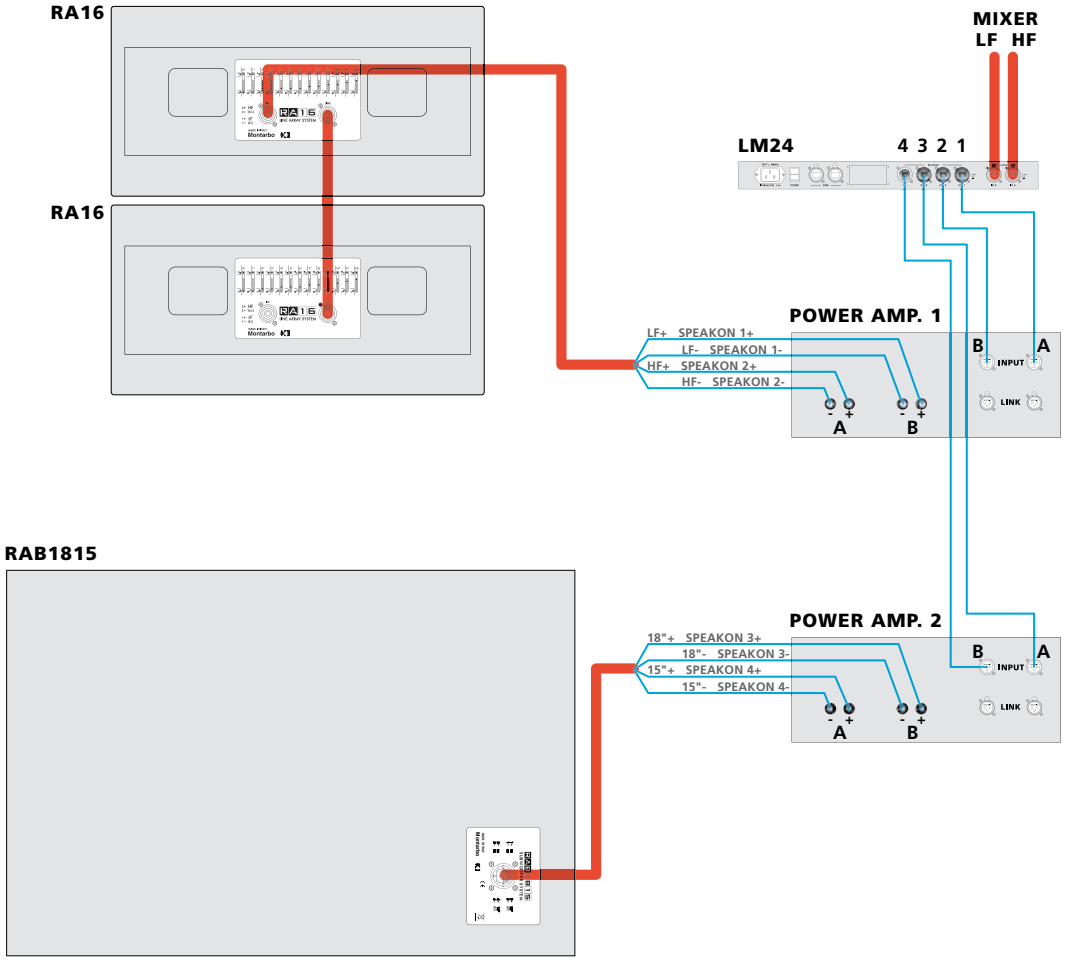
PALCOPLUS wiring with LM24 controller - inputs A & B (PalcoPlus in A&B)

Name	Description	Input A	Input B	Output 1	Output 2	Output 3	Output 4
PalcoPlus in A&B	PalcoPlus Flown A & B inputs	HF input	LF input	RA16 HF (2 couples) Flown	RA16 LF (2 couples) Flown	RAB1815 15" (1 couple)	RAB1815 18" (1 couple)



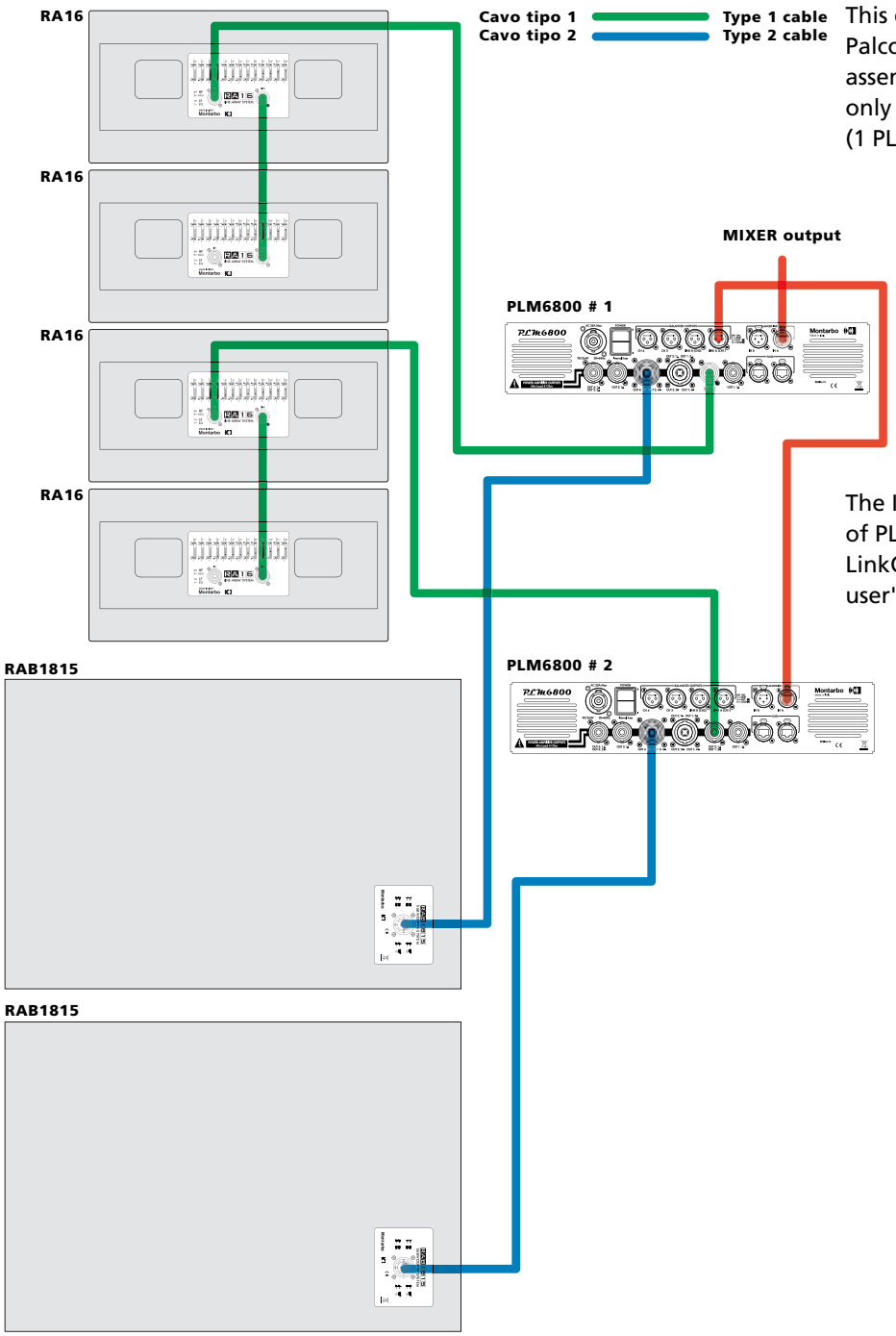
PALCOPLUS wiring with LM24 controller - small configuration, inputs A & B (MiniPalco+ in A&B)

Name	Description	Input A	Input B	Output 1	Output 2	Output 3	Output 4
MiniPalco+ in A&B	PalcoPlus Stacked A & B inputs	HF input	LF input	RA16 HF (1 couple) Stacked	RA16 LF (1 couple) Stacked	RAB1815 15" (single)	RAB1815 18" (single)



PALCOPLUS wiring with PLM6800 power controller - standard configuration (RA16 + RAB1815 A Flw)

Name	Description	PLM6800 n. 1	Input A	Input B	Ch 1	Ch 2	Ch 3	Ch 4
RA16 + RAB1815 A Flw	Standard PalcoPlus flown		Mono	Disabled	RA16 HF (1 couple) flown	RA16 LF (1 couple) flown	RAB1815 no. 1 15"	RAB1815 no. 1 18"
		PLM6800 n. 2	Input A	Input B	Ch 1	Ch 2	Ch 3	Ch 4
			Mono	Disabled	RA16 HF (1 couple) flown	RA16 LF (1 couple) flown	RAB1815 no. 2 15"	RAB1815 no. 2 18"



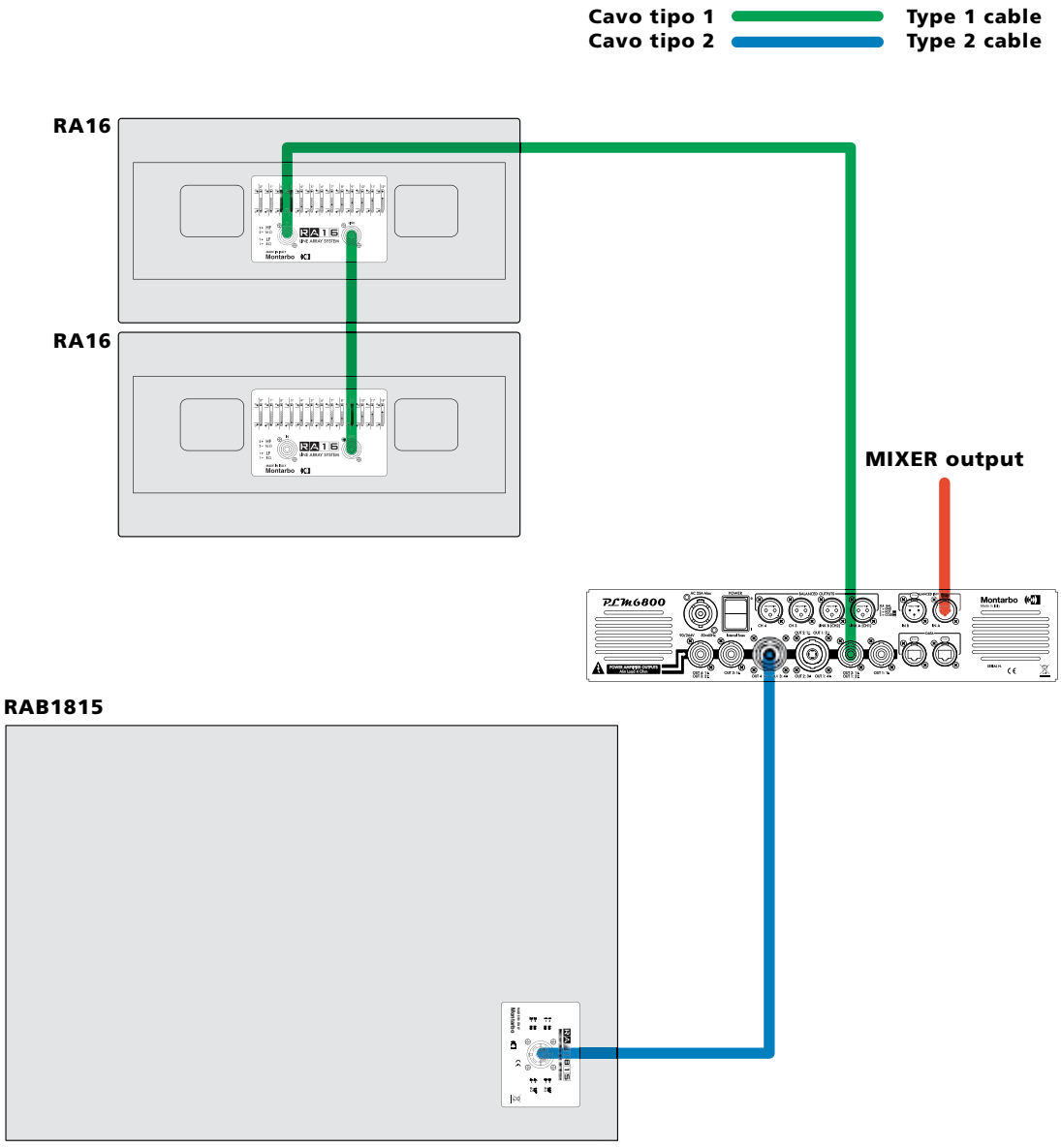
This example shows a standard PalcoPlus system. It is possible to assemble a reduced system, using only half of the above components (1 PLM6800 + 2 RA16 + 1 RAB1815).

Attention!
The InLink configuration parameter of PLM6800 no. 1 must be set to LinkOn (default). Refer to PLM6800 user's manual.

PALCOPLUS wiring with PLM6800 power controller - small configuration (RA16 + RAB1815 A Stk)

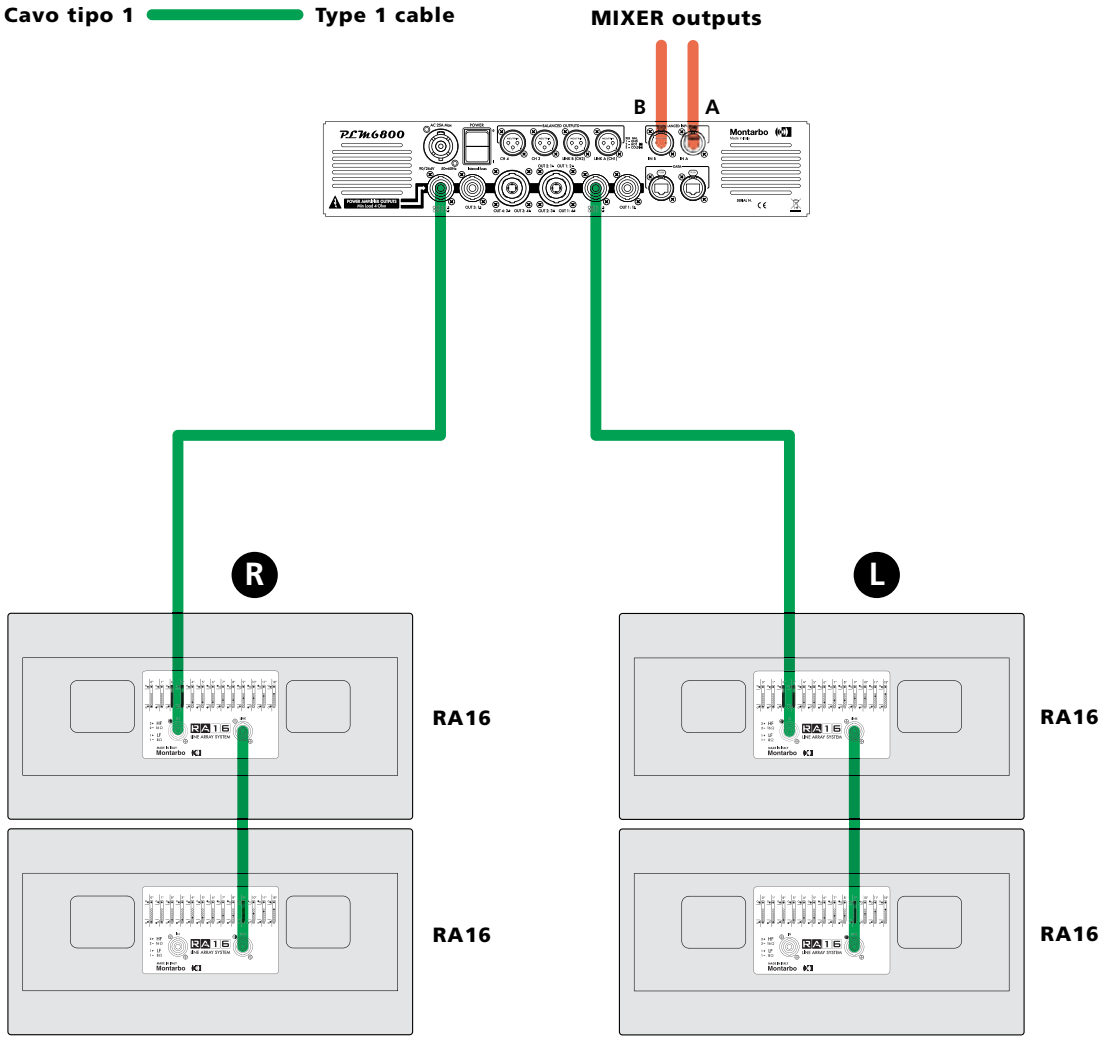
Name	Description	Input A	Input B	Ch 1	Ch 2	Ch 3	Ch 4
RA16 + RAB1815 A Stk	PalcoPlus stacked	Mono	Disabled	RA16 HF (1 couple) stacked	RA16 LF (1 couple) stacked	RAB1815 15"	RAB1815 18"

This example shows a PalcoPlus system in a small configuration. It is possible to assemble a larger system, using the double of the above components (2 PLM6800 + 4 RA16 + 2 RAB1815), wiring the second PLM6800 as described in the preceding page.



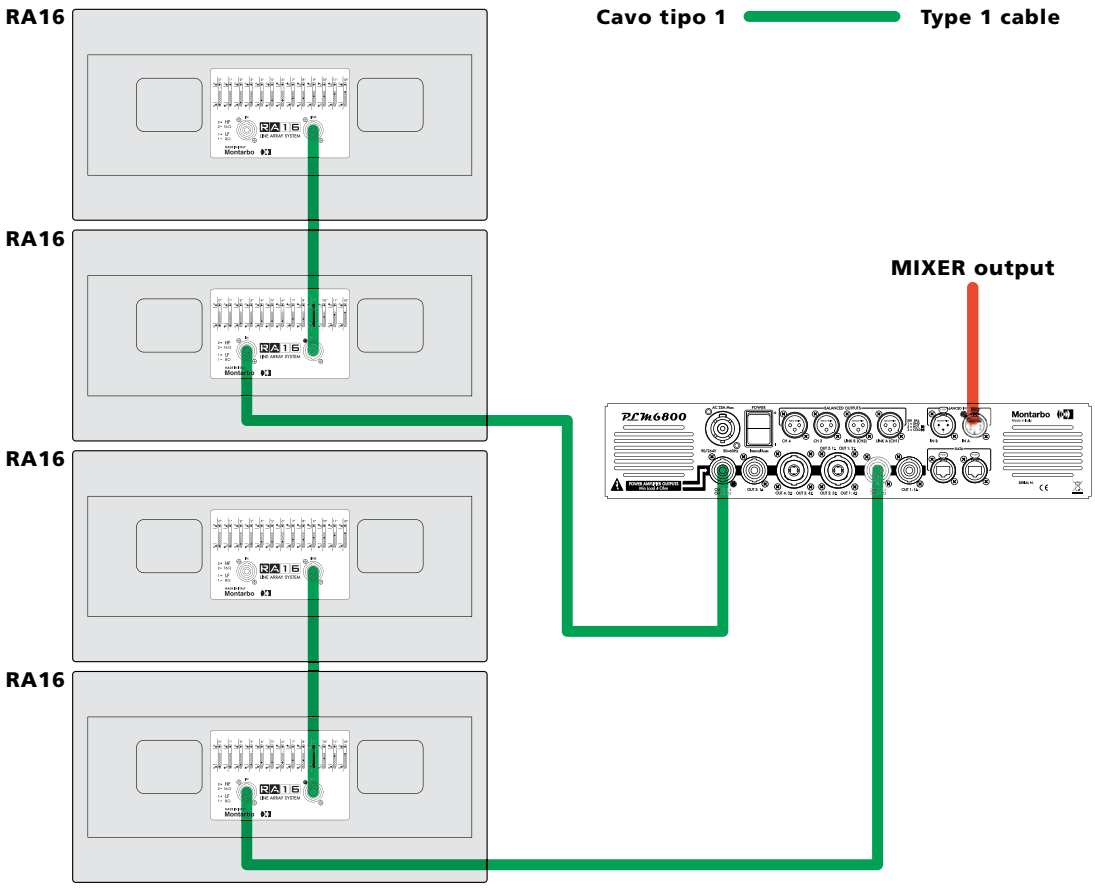
PALCOPLUS wiring with PLM6800 power controller - RA16 stereo configuration (RA16 + RA16 A&B)

Name	Description	Input A	Input B	Ch 1	Ch 2	Ch 3	Ch 4
RA16 + RA16 A&B	RA16 (2 couples) stereo	Ch L	Ch R	RA16 HF flown - L	RA16 LF flown - L	RA16 HF flown - R	RA16 LF flown - R



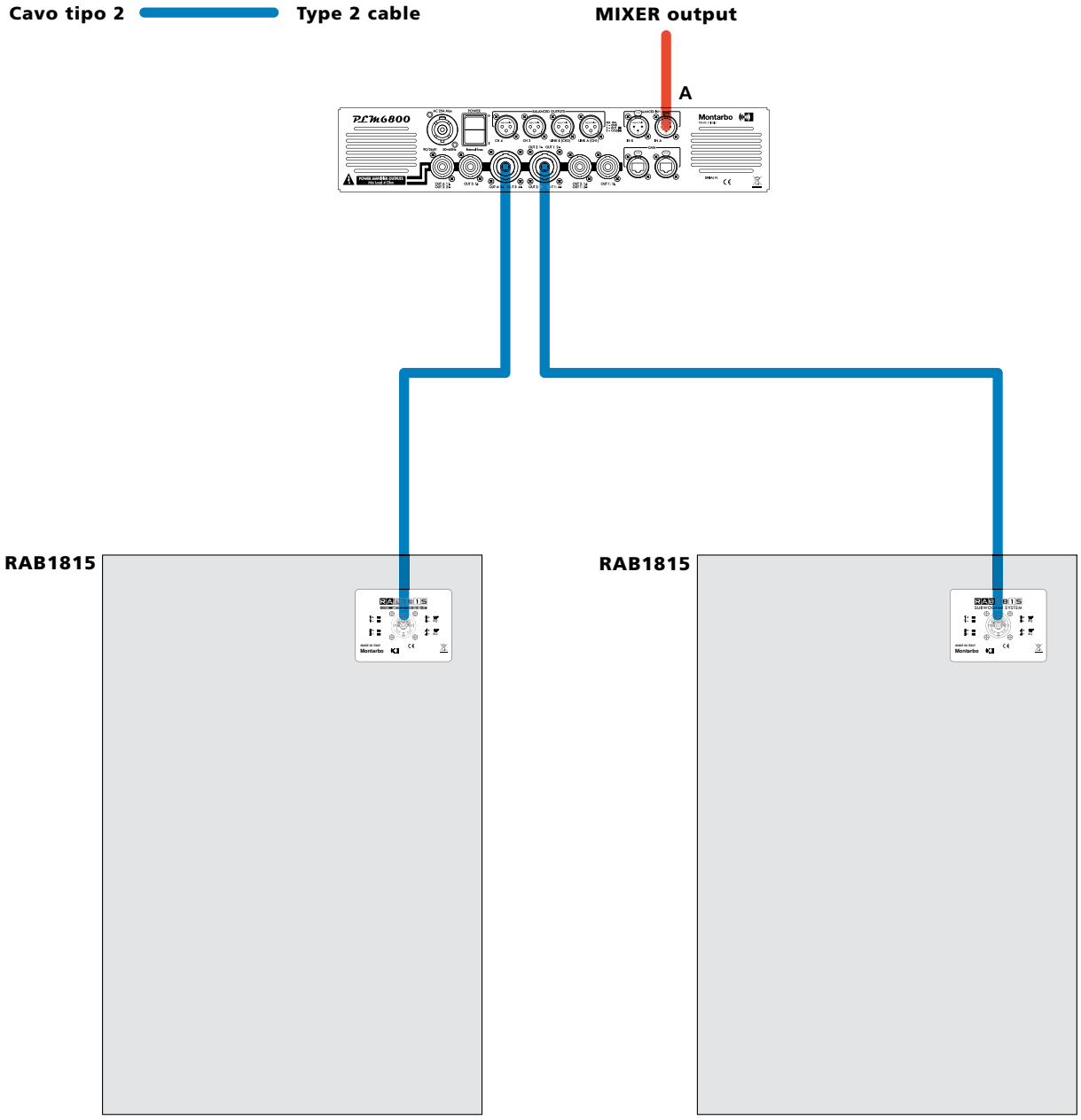
PALCOPLUS wiring with PLM6800 power controller - split RA16 configuration (RA16 4Ch in A)

Name	Description	Input A	Input B	Ch 1	Ch 2	Ch 3	Ch 4
RA16 4Ch in A	RA16 (2 couples) channel A	Mono	Disabled	RA16 HF (1 couple)	RA16 LF (1 couple)	RA16 HF (1 couple)	RA16 LF (1 couple)



PALCOPLUS wiring with PLM6800 power controller - RAB1815 split configuration (RAB1815 x 2 in A)

Name	Description	Input A	Input B	Ch 1	Ch 2	Ch 3	Ch 4
RAB1815 x 2 in A	RAB1815 split array	Active	Disabled	RAB1815 no. 1 15"	RAB1815 no. 1 18"	RAB1815 no. 2 15"	RAB1815 no. 2 18"



6 - POWER AMPLIFIER SELECTION

When selecting a power amplifier, don't go for "just enough power".
An underpowered amplifier will provide no performance advantages, not even in terms of reliability (indeed, loudspeakers are more prone to failure when driven by an underpowered amplifier), and the dynamics of the whole system may be compromised.
To ensure that a system is operating at top capacity and best expressing its dynamic, detailed sound image, **very powerful amplifiers** are required.

The recommended amplifiers for the PALCOPLUS system must have the following specifications:

Output power	at least 1500 W RMS @ 4 ohms
Gain	36 dB

This gain value corresponds to the factory default value for the **OutAttn** parameter in the LM24 controller (see chapter 7).
Amplifiers with different gain or input sensitivity values may be used, as long as the OutAttn value in the controller's configuration is adequately modified.

Theoretically speaking, the amplifiers used to drive the HF section of the RA16 enclosures could be of a lower power rating (considering the 8-ohm impedance of two parallel-connected cabinets), but we strongly suggest employing identical amplifiers for all the system's components. There are many reasons for this: the system's organization, the wiring and even the spare parts inventory are thus simplified; plus, there's no need for a different configuration of some of the controllers.

Other than power rating, there are other amplifier characteristics that are of primary importance:

- sound quality ("musicality")
- reliability
- small size and weight (this is especially critical in the case of "touring" systems)

In the case of the first and the second characteristics, a good strategy is to always deal with a reliable, established supplier.
Always keep in mind that a cheap amplifier is more prone to failure, and a failure of the power amplifier may lead to a serious failure of the system drivers.
In the case of the third consideration, it is advisable to select switching amplifiers (class D or similar) with a switching-mode power supply. These are more compact and weigh less, resulting in smaller and lighter racks.

Two-ohm operation.
Many professional power amplifiers may operate on very low loads and some of them are specified for continuous operation on 2-ohm loads.
It would therefore seem possible to employ one of these "low-impedance-capable" amplifiers to drive two parallel-connected RAB1815 subwoofers (one channel for the two 18", the other for the two 15"), or 4 parallel-connected RA16 enclosures (one channel for the four LF sections, the other for the four HF sections).
And, although this is certainly possible, it is not recommended for one or more of the following reasons:
- 2-ohm operation increases the heat generated by output and power supply stages, reducing the amplifiers' reliability, making them more prone to catastrophic failures.
- the high current involved calls for a detailed study of the amplifier-speaker wiring, and the wiring will inevitably become more complicated and complex.
- the failure of one amplifier will result in an "out of service" condition (a dramatic muting) of twice the number of speakers, and this may compromise the entire performance in course.
- the dynamic range and the damping factor of an amplifier operating on a very-low-impedance load are significantly reduced, and this may compromise the exceptional dynamic and transient response of the PALCOPLUS system.

6.1 PLM6800 powered controller - 4-channel power amplifier with digital loudspeaker management

The use of the PLM6800 gives a number of important advantages:
- the internal amplifiers' gain and power have been optimized for the PALCOPLUS system;
- the small size and weight give a great space saving;
- system wiring is simplified beacuse all the required power connectors (Speakon® NL4 e NL8) are ready installed on the amplifier's rear panel, and thus there's no need to fabricate dedicated wiring panels or adapter cables;
- the 'intelligent' control of the outputs' wiring (the output connectors are selectively enabled by the digital controller according to the loaded preset), gives total protection to the speaker's components against wiring errors.

7 - EASE Focus AIMING SOFTWARE

This program has been developed by the SDA Company (Software Design Ahnert GmbH) and the supplied version has been customized for the PALCOPLUS system, whose acoustical and mechanical parameters are pre-loaded.

7.1 - NOTES ABOUT OPERATING SYSTEM

The software operates on the Microsoft **Windows 2000®, Windows XP® or Windows VISTA®** operating system, with the .NET Framework version 1.1 redistributable package.

7.2 - INSTALLATION

The software installation may be started automatically, at the end of the installation process of RACon software, by simply clicking the ***Install EASE Focus*** tab (see chapter 8), or it can be started manually using the CD supplied with the USB LD 2.4 interface.

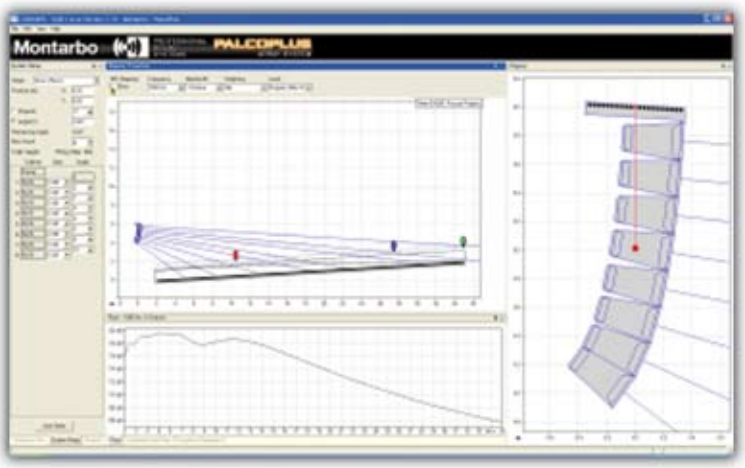
EASE Focus requires the Microsoft® "**.NET 1.1** " libraries.
If these are not installed on your PC, you can install them by executing the dotnetfx.exe file present on the supplied CD.

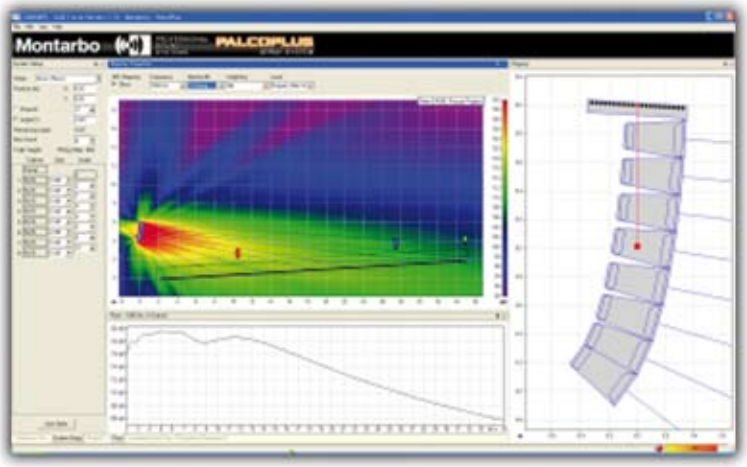
7.3 - PROGRAM OVERVIEW

The purpose of EASE Focus is to provide both the end user, who needs to set up the array for a show, as well as the developer, with a tool that allows the easy and quick prediction of the array's performance in a given venue

The software has been developed on the Microsoft® .Net Framework, and offers ease of use, high performance and portability.

EASE Focus is a software that allows the modeling of acoustic sources, in particular line arrays, in two dimensions.
It considers the direct field created by the complex addition of the sound contributions of the individual loudspeakers or array elements.
Based on an intuitive and consistent interface, EASE Focus is designed for the end user, as well as the R&D engineer.





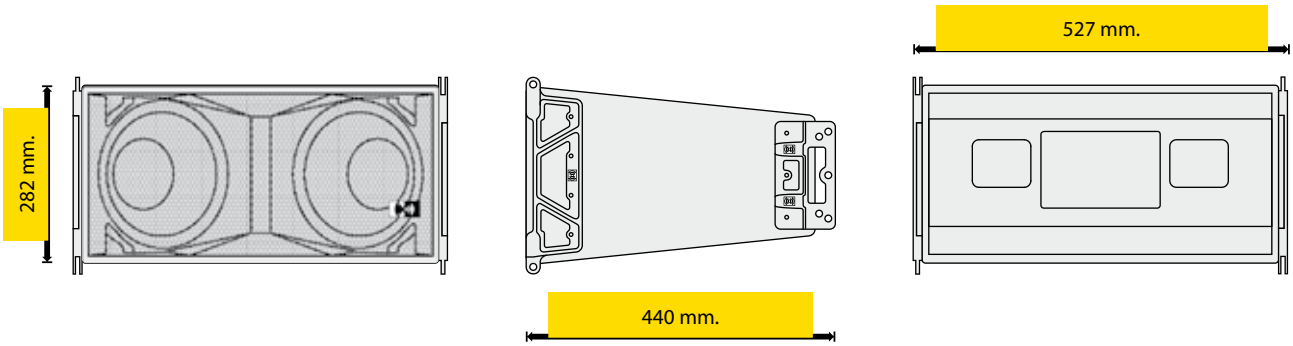
- Aiming and color mapping display
- Zoomed rigging display
- Extended report for printing
- Levels over audience areas
- COM and tilt angle calculation for selected pinpoint
- Presets for audience areas and array setup
- English and German language versions
- SPL display in 1/3rd octaves, octaves, 3 octaves, and broadband
- RMS, program (max SPL for short periods) and peak levels
- Flat and A-weighted levels
- Air attenuation according to ISO 9613
- Amplitude shading, that allows to calculate the attenuation required for the speakers assigned to the coverage of the near areas.
- Optimized SPL calculation routines for interactive aiming.

The program includes a complete and detailed on-line help, and we suggest that the user refer to it for more details.

8 - PALCOPLUS SYSTEM TECHNICAL DATA

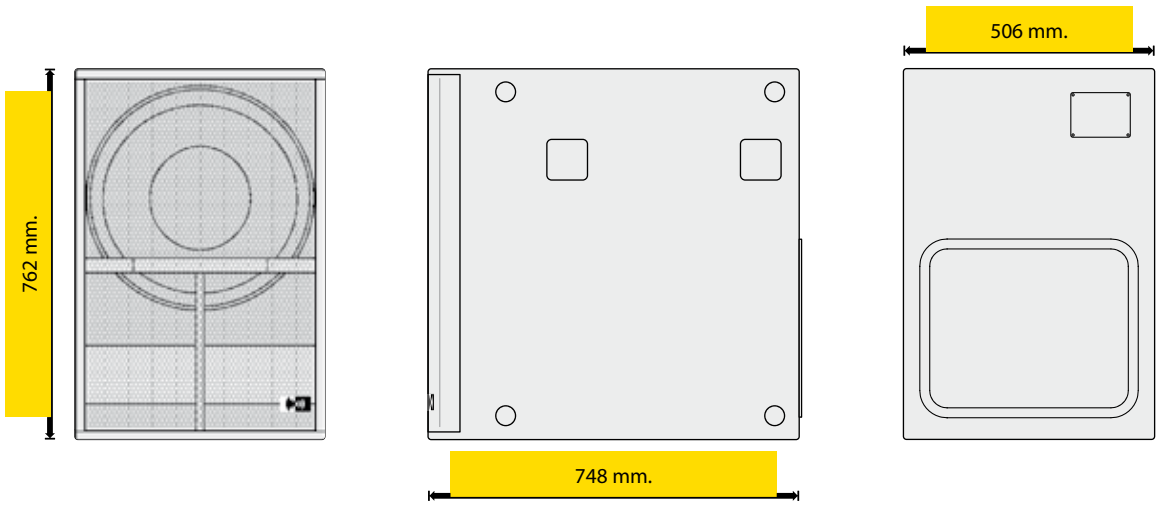
RA16 - SPEAKER ENCLOSURE

Frequency Response	70 Hz ÷ 20 kHz
Cross-over	800 Hz, 24 dB/oct
Max Power Handling	
LF: 2 x 8" (2,5" voice coil)	800 watts @ 8 ohms
HF: driver (3" voice coil / 1,4" throat)	200 watts @ 16 ohms
MAX SPL @ 1 m	130 dB (single enclosure)
Coverage Angle	120° Horizontal
	Vertical coverage depends from the array adjustment (2 x 6° trap angle)
Dimensions and Weight	W 527 x H 282 x D 440 mm; 18 kg



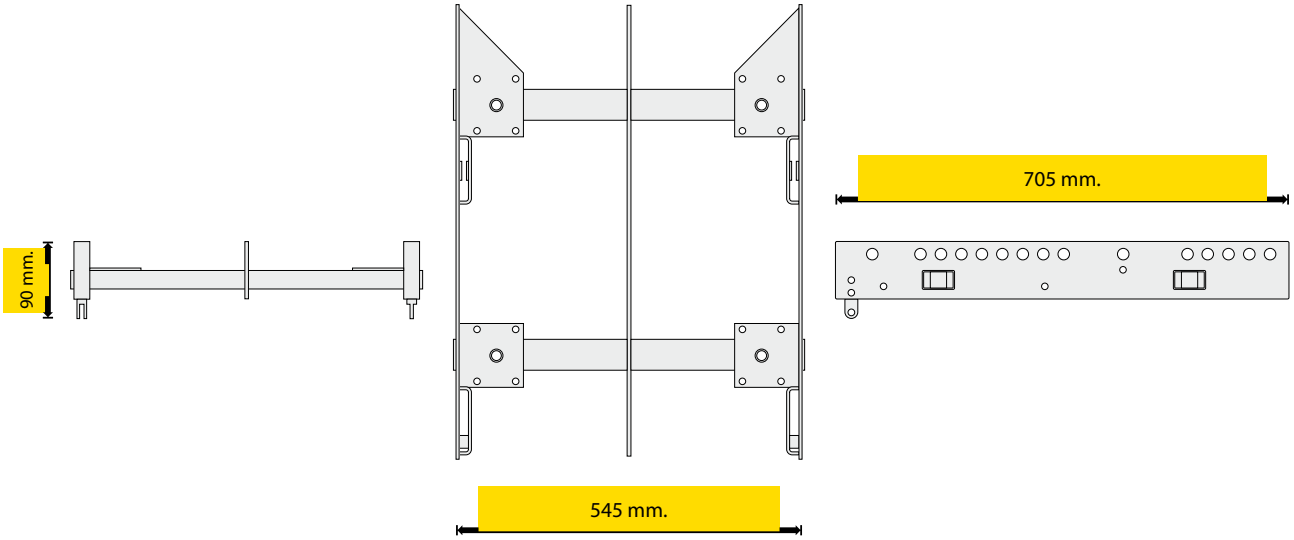
RAB1815 - SUB-BASS UNIT

Frequency Response	30 Hz ÷ 120 Hz
Max Power Handling	
18" (4" voice coil)	1600 watts @ 4 ohms
15" (4" voice coil)	1600 watts @ 4 ohms
MAX SPL @ 1m	136 dB (half space)
Directivity	Cardioid polar pattern
Dimensions and Weight	W 506 x H 762 x D 748 mm; 58 kg



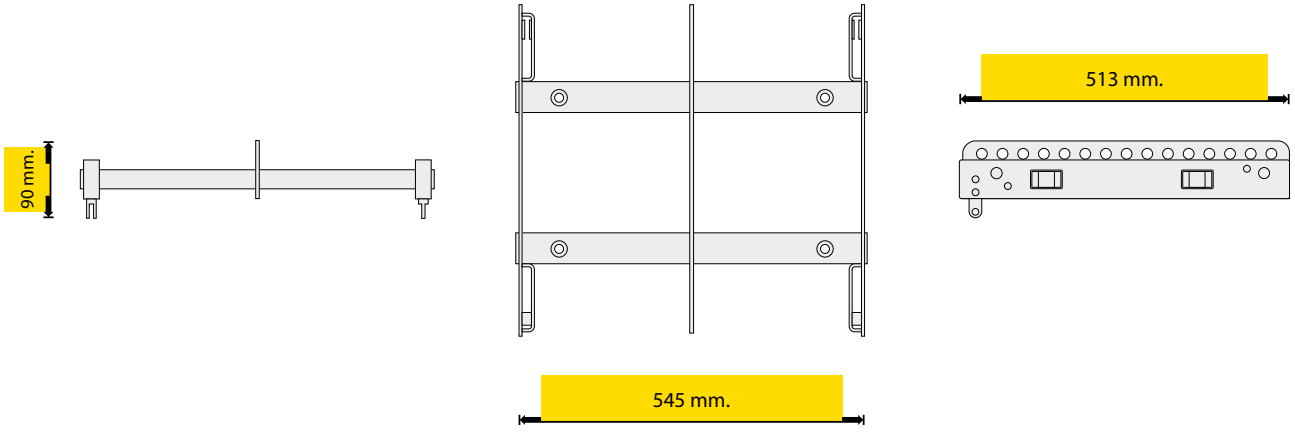
BUMPER - B1

Material	FE360 structural steel
Dimensions and Weight	W 545 x H 90 x D 705 mm; 13 kg
Max allowable load	320 kg (suspended)
Load capacity	max. 16 x RA16 flown (288 kg)

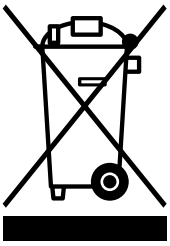


BUMPER - B2

Material	FE360 structural steel
Dimensions and Weight	W 545 x H 90 x D 513 mm; 8,5 kg
Max allowable load	320 kg (suspended)
Load capacity	max. 8 x RA16 flown (144 kg)



Waste from Electrical and Electronic Equipment



Attention !

The crossed out wheeled bin symbol that can be found on this product means that the product is covered by the Waste from Electrical and Electronic Equipment Directive. The symbol is intended to indicate that waste from electrical and electronic equipment must be subject to a selective collection.
For more details on available collection facilities please contact your local government office or the retailer where you purchased this product.

The solid bar underneath indicates that the product has been put on the market after 13th August 2005.

INFORMATION ON PROPER DISPOSAL

Information on Disposal for Users (private households)

In the European Union
Attention: If you want to dispose of this equipment, please do not use the ordinary dust bin! Used electrical and electronic equipment should not be disposed of via the normal household waste stream but must be treated separately and in accordance with legislation that requires proper treatment, recovery and recycling of used electrical and electronic equipment.
Following the implementation by member states, private households within the EU states may return their used electrical and electronic equipment to designated collection facilities free of charge*. In some countries* your local retailer may also take back your old product free of charge if you purchase a similar new one. * Please contact your local authority for further details.
In other Countries outside the EU: If you wish to dispose of this product, please contact your local authorities and ask for the correct method of disposal.
In Switzerland: Used electrical or electronic equipment can be returned free of charge to the dealer, even if you don't purchase a new product. Further collection facilities are listed on the homepage of www.swico.ch or www.sens.ch.

Information on Disposal for Professional Users

In the European Union
If the product is used for business purposes and you want to discard it: please contact your Montarbo dealer who will inform you about the take-back of the product. You might be charged for the costs arising from take-back and recycling. Small products (and small amounts) might be taken back by your local collection facilities.
In Spain: Please contact the established collection system or your local authority for takeback of your used products.
In other Countries outside the EU: please contact your local authorities and ask for the correct method of disposal.

APPENDIX

Certificazione di sicurezza dei componenti
Safety and compliance certification of system's components

ELETTRONICA MONTARBO S.r.l.
Via G. Di Vittorio n° 13
40057 Cadriano di Granarolo (BO)

STVDIO TECNICO
ing. Franco Faggiotto, via G.Regnoli 10,47100 Forlì
Tel.0543-43961 Fax.0543-21224 e-mail ingfaggiotto@libero.it

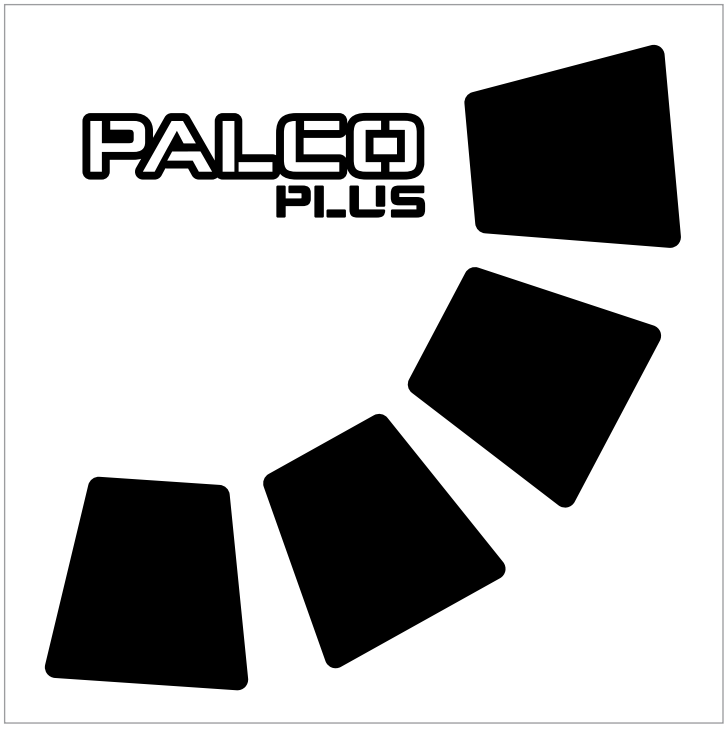
Oggetto: **CALCOLO DELLA PORTATA DEGLI ELEMENTI DI CONNESSIONE MONTARBO IN MICROFUSIONE, ABBINATI A BUMPER E BUMPER PICCOLO**

Calcolatore delle strutture: **Dott. Ing. FRANCO FAGGIOTTO**

Timbro e Firma

Data: **Forlì 04 Dicembre 2008**

Dott. Ing. Franco Faggiotto – Via G. Regnoli n. 10 47100 Forlì
Telefono 0543 34961 – Fax 0543 21224 - Cell. 348 3531928



Le informazioni contenute in questo manuale sono state attentamente redatte e controllate. Tuttavia non si assume alcuna responsabilità per eventuali inesattezze. Questo manuale non può contenere una risposta a tutti i singoli problemi che possono presentarsi durante l'installazione e l'uso dell'apparecchio.
Siamo a vostra disposizione per fornirvi eventuali ulteriori informazioni e consigli.

La Elettronica Montarbo srl non può essere ritenuta responsabile per danni o incidenti a cose o persone, causati o connessi all'utilizzazione o malfunzionamento dell'apparecchio.

Caratteristiche, dati tecnici e immagini possono essere modificati senza preavviso.

The information contained in this manual have been carefully drawn up and checked. However no responsibility will be assumed for any incorrectness.
This manual cannot cover all the possible contingencies which may arise during the product installation and use. Should further information be desired, please contact us or our local distributor.

Elettronica Montarbo srl can not be considered responsible for damages which may be caused to people and things when using this product

Specifications, features and pictorial material are subject to change without prior notice.

RA16
RAB181S
LIM24
LIM24
LD24
B1
B2
RAON

EASE Focus

PROFESSIONAL ARRAY SYSTEM

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Montarbo
Made in Italy